The DUNHAM HEATING EQUIPMENT

C. A. DUNHAM CO. LIMITED
1523 DAVENPORT RD. TORONTO

ST. JOHN'S MONTREAL WINNIPEG
HALIFAX OTTAWA CALGARY
QUEBEC TORONTO EDMONTON
SHERBROOKE HAMILTON VANCOUVER

The C. A. Dunham Company Limited, is engaged solely in the problem of making steam an easily managed and economical servant. Representatives are available for Engineering counsel in correct selection of heating equipment described in this Product Catalogue. This cooperation is available for the modernization of old steam heating systems as well as for new equipment.

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DUNHAM DIFFERENTIAL VACUUM HEATING SYSTEM

. . . . .

The Dunham Differential Vacuum Heating System is a simple two-pipe system using steam at variable pressures and temperatures to balance the heat loss from a building under changing weather conditions. During very cold weather, which constitutes less than 5% of the average heating season, operation is similar to the vacuum return line system with low vacuum in the return only and steam pressures above atmosphere in the supply. To meet the changing heating requirements during the milder portion of the heating season, high vacuum is maintained in the return with steam pressures below atmosphere in the supply piping and radiation.

In addition to the heating appliances used with the ordinary uncontrolled vacuum return line system, there is equipment for coordinating the control of circulation, distribution and heat supply.

CIRCULATION—Positive and continuous circulation of steam at pressures above and below atmosphere is controlled by maintaining a relatively fixed difference in pressure between the supply and return piping.

DISTRIBUTION—The proportional distribution of steam to each heating unit is accomplished by means of regulating plates or adjustable orifices at the inlet to each unit.

HEAT SUPPLY—The rate of steam supplied to the system is controlled to permit the heat output to balance the demand. The control equipment affords a continuous but variable supply of steam under fully automatic or manual operation as selected for the special requirements of the building.

The Differential System fulfills the basic heating requirements of all buildings. These are

(1) To maintain constant, comfortable and healthful temperatures.

(2) To reduce heating at night or whenever the building is unoccupied.

(3) To warm up the building quickly without temperatures rising above normal.

(4) To eliminate all heating in very mild weather whenever building temperatures rise above normal.

(5) To provide a continuous supply of steam which is regulated to meet the demand by frequent but small increment changes.

(6) To even distribution of heat throughout the building.

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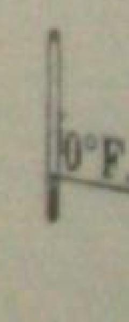

HEAT LOSS
OF BUILDIN
10,395
HEAT UNIT
PER HOUR

Replaces File
Dated:

DUNHAM DIFFERENTIAL VACUUM HEATING SYSTEM
SUB-ATMOSPHERIC STEAM HEATING PRINCIPLES

Three simple facts have been applied in Dunham Differential Heating to give a variable heat output. The first fact is that the temperature of steam is not constant but variable dependent upon its pressure. The second that, if the pressure is reduced, the temperature falls and the heat output also, and vice versa. The third fact, obviously simple, is that a radiator when only partly filled with steam gives off less heat than when it is completely filled with steam at the same temperature.

A Dunham Differential System distributes steam to the radiation continuously at pressures all the way from 2 pounds above atmosphere down to 25 inches of vacuum by the gauge, and thus at corresponding temperatures from approximately 218° F. down to 133° F. During severe winter weather, steam at the higher temperatures meets the maximum heat requirements. During average winter weather, low-temperature steam satisfies the heat demand. When the heat requirements are still lower, as during the autumn and spring and the very mild days in winter, partial filling of the radiation with low-temperature steam extends the range of heat output to hold it constantly in balance with the demand. The percentage of partial filling is under control just as is the reduction in steam temperature. As the weather grows milder the heat output is held parallel to the building demand by a progressive reduction in the degree of partial filling until finally there is no further need for any artificial heat.

The application of this 100 per cent range of heat output flexibility to buildings is illustrated in Fig. 1075D. In "A" the outside temperature is 0° F. (the "design basis" for many localities), the inside temperature is 70° F. and the heat loss through the wall of the room is 10,395 British thermal units per hour. The radiator filled with steam at 2 pounds pressure and 218.5° F. temperature gives off the required 10,395 Btu to maintain the room temperature constant. In "B" the outside temperature has risen to 49° F. and the heat loss has consequently decreased to 3156 Btu per hour. By lowering the steam pressure to 25 inches of vacuum and the steam temperature in consequence to 133.2° F., the heat output from the radiator is reduced to the requisite 3156 Btu to maintain room temperature at 70° F. "C" illustrates what happens during very mild weather operation. The outside temperature is 60° F. The heat loss has consequently dropped to 1485 Btu per hour but the heat output from the radiator has been equally reduced by reducing the volume of steam delivered to the radiator until a percentage of partial filling which just balances the low heat requirement is reached.

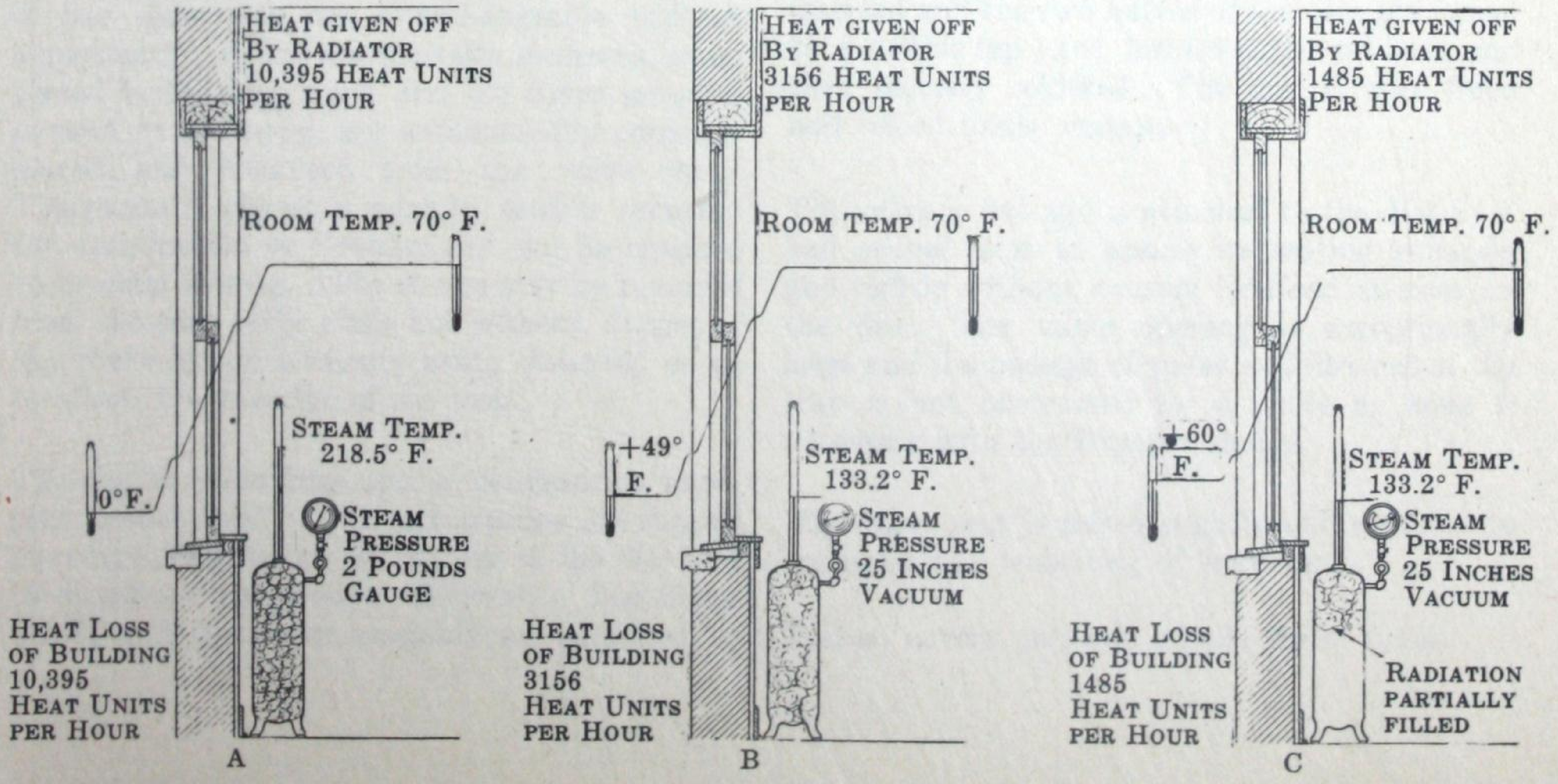
Heat given off By Radiator 10,395 Heat Units per Hour
Room Temp. 70° F.
Steam Temp. 218.5° F.
0°F.
Steam Pressure 2 Pounds Gauge
Heat Loss of Building 10,395 Heat Units per Hour
A
Heat given off By Radiator 3156 Heat Units per Hour
Room Temp. 70° F.
+49° F.
Steam Temp. 133.2° F.
Steam Pressure 25 Inches Vacuum
Heat Loss of Building 3156 Heat Units per Hour
B
Heat given off By Radiator 1485 Heat Units Per Hour
Room Temp. 70° F.
+60° F.
Steam Temp. 133.2° F.
Steam Pressure 25 Inches Vacuum
Radiation partially filled
Heat Loss of Building 1485 Heat Units per Hour
C

Fig. 1075D

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API INTERNATIONAL

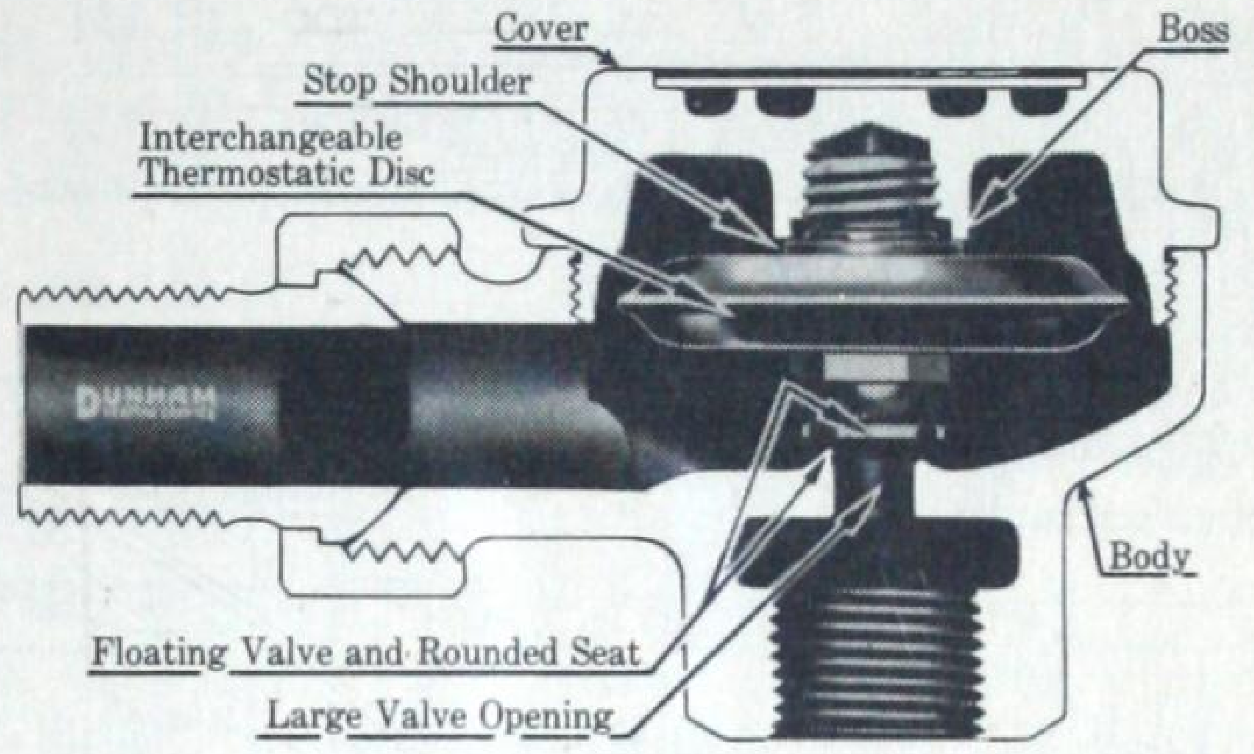
CCA

DUNHAM THERMOSTATIC TRAP

STANDARD—Nos. 1B, 2C and 3B
WITH INTERCHANGEABLE DISC

DESIGN—Design of the Dunham Trap provides for (a) efficient differentiation between steam and air-and-water, (b) simple rugged construction, (c) freedom from clogging, (d) minimum depositing of incrustants on valve seat, (e) thorough draining of radiators by gravity, and (f) minimum wear on working parts. These features ensure dependable service.

The standard trap operates efficiently over a pressure range from 15 pounds gauge down to 15 inches of vacuum and is used on all types of low pressure steam heating systems.


Cover
Boss
Stop Shoulder
Interchangeable Thermostatic Disc
DUNHAM
Body
Floating Valve and Rounded Seat
Large Valve Opening

Sectional View of Thermostatic Trap with Interchangeable Disc
Fig. 3096

CONSTRUCTION—The trap consists of two principal parts—a body with the valve seat and a cover containing the expansion thermostat. The trap is non-adjustable; permanent adjustments for correct operation are built into the element. The thermostatic elements for traps of the same size are interchangeable without adjustment. Spare thermostatic elements, when placed in the trap cover and the cover properly secured to the body, are automatically correctly placed and distanced from the valve seats. Thermostatic elements may be readily removed for examination or cleaning and can be replaced to original setting. The covers may be removed from the trap body while hot without danger of the thermostatic elements being distorted so as to affect the operation of the trap.

The disc is made from special composition phosphor bronze sheet. The corrugations are shaped to reduce hinge action at the rim of the disc and to distribute disc motion uniformly. The filling nozzle and the valve assembly are attached to their respective halves of the disc by threaded nuts making tight screwed joints which are further reinforced, locked and sealed by sweating with solder.

A crimped ring, which prevents disc vibration, is inserted and the two halves of the disc are joined by a double lap joint, formed under pressure and then securely soldered. The disc is then filled and sealed under vacuum.

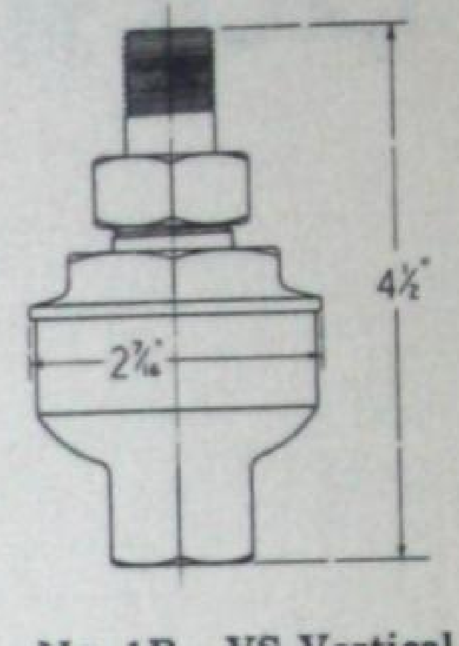
The valve is flat and is attached to the disc by a ball swivel joint to ensure its seating squarely and tightly without causing localized stresses on the disc. The valve opening is exceptionally large and the passage of water and dirt out of the trap is not obstructed by a guide as none is necessary with the Dunham design.

The valve seat is raised slightly and rounded to minimize the depositing of incrustants.

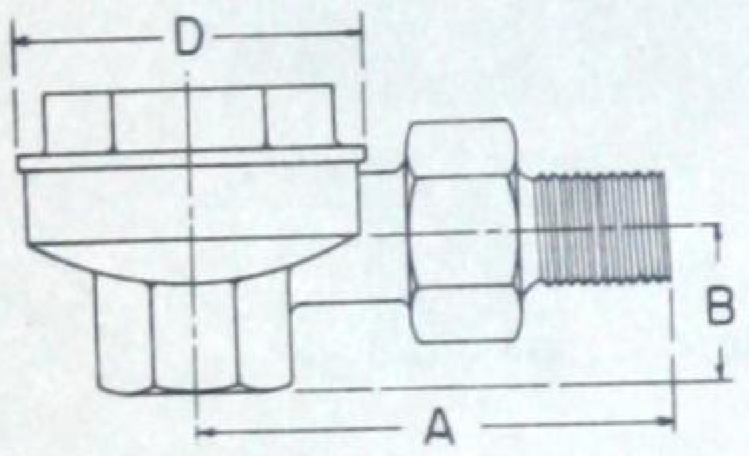
Bodies, covers, nut and nipple are of brass.

FOR NORMAL OPERATING PRESSURES NOT EXCEEDING 15 POUNDS GAUGE

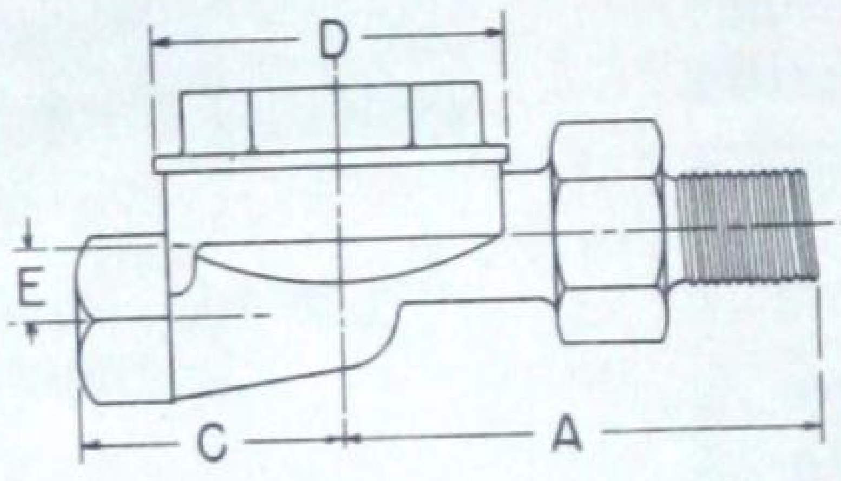
Max. 15 pounds Min. 15" Vacuum		Pattern	Tapping Inches	Capacity Sq. Ft. EDR	Net Weight Lbs.	Dimensions in inches				
Size No.	Code					A	B	C	D	E
1B	Atom	A.P.	½	200	1¼	3¼	1⅛	...	2 7/16	...
	Atude	S.W.			1⅜	3¼	...	1¾	2 7/16	½
	Attos	R.H.			1⅜	3 7/16	...	1¾	2 7/16	½
	Atwan	L.H.			1⅜	3 7/16	...	1¾	2 7/16	½
	Atypie	V.S.			1¼	For dimensions see Fig. 3105				
2C	Abhor	A.P.	½	400	1 11/16	3¼	1⅛	...	3 1/16	...
	Abbey	S.W.			1¾	3¼	...	1¾	3 1/16	½
3B	Alp	A.P.	¾	700	1⅞	3 5/16	1⅛	...	3 1/16	...



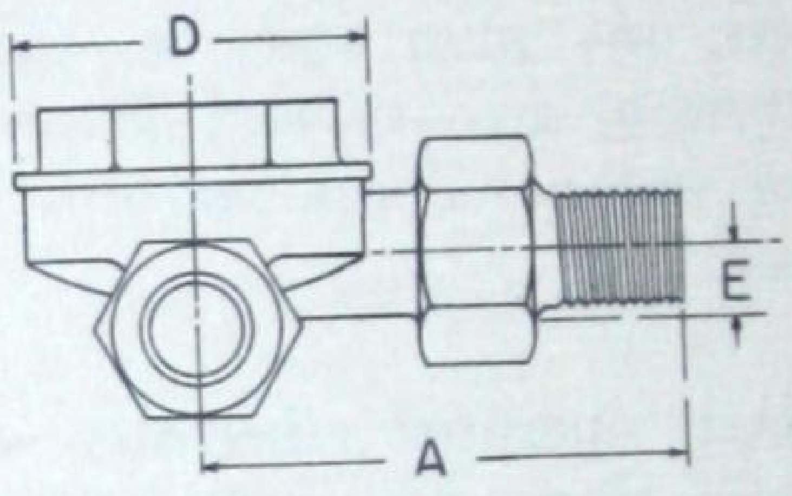
No. 1B—VS Vertical Trap pattern
Fig. 3105

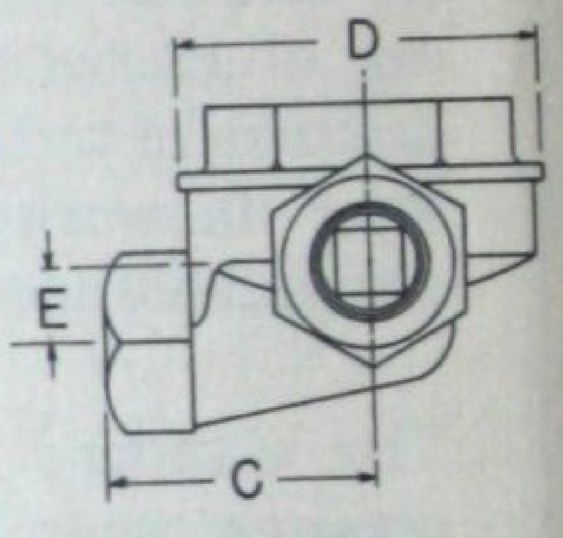


Angle pattern
Fig. 805-1



Straightway pattern
Fig. 805-2





Right hand corner pattern—Left hand dimensions same
Fig. 805-A
Fig. 805-3

PARTS

Letters after trap numbers indicate change in models. These appear on trap nameplates and should be given when ordering parts. If nameplate is obliterated, give the diameter of the cap and size of tapping. Nos. 1B, 2C and 3B caps and discs must be supplied as a unit for replacements on Nos. 1A, 2B and 3A traps unless used caps are returned for factory adjusted discs to assure accurate setting.

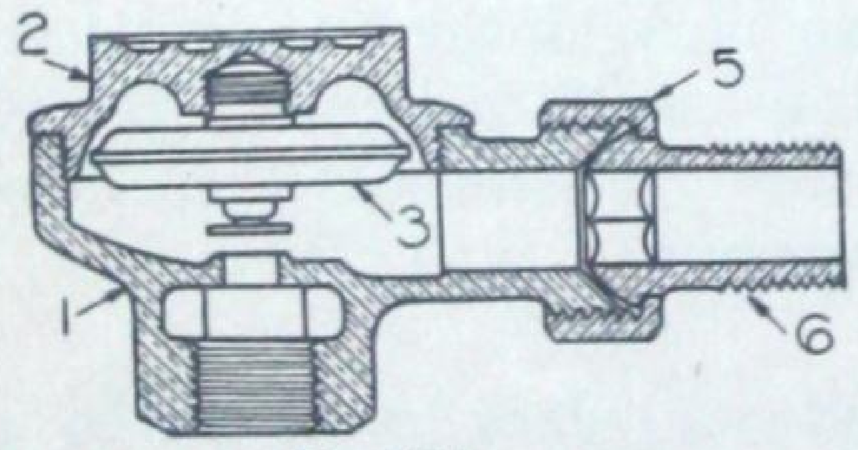


Fig. 865A
No. 1A Trap

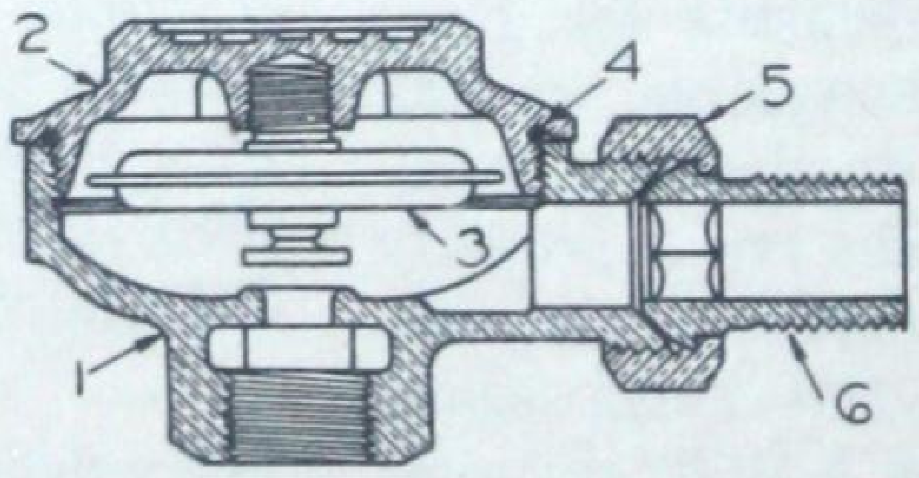


Fig. 865B
Nos. 2B and 3A Traps

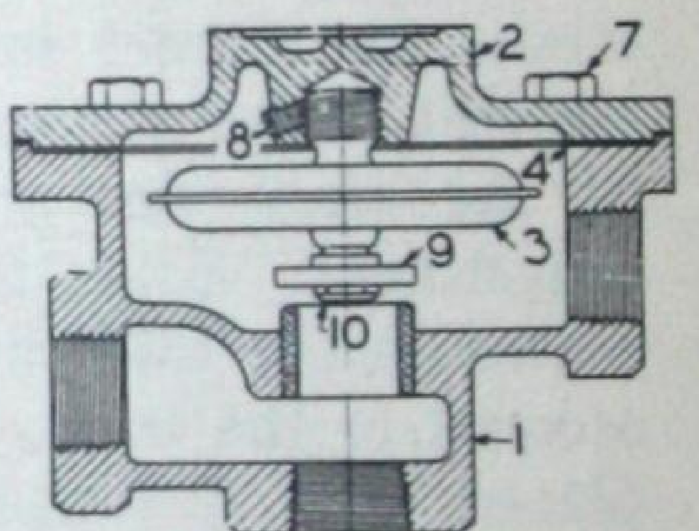


Fig. 866B
Nos. 4A and 5A Traps.

1. Body
2. Cap
3. Disc
4. Gasket
5. Union Nut
6. Union Nipple
7. Cap Screw
8. Set Screw
9. Valve
10. Valve Nut

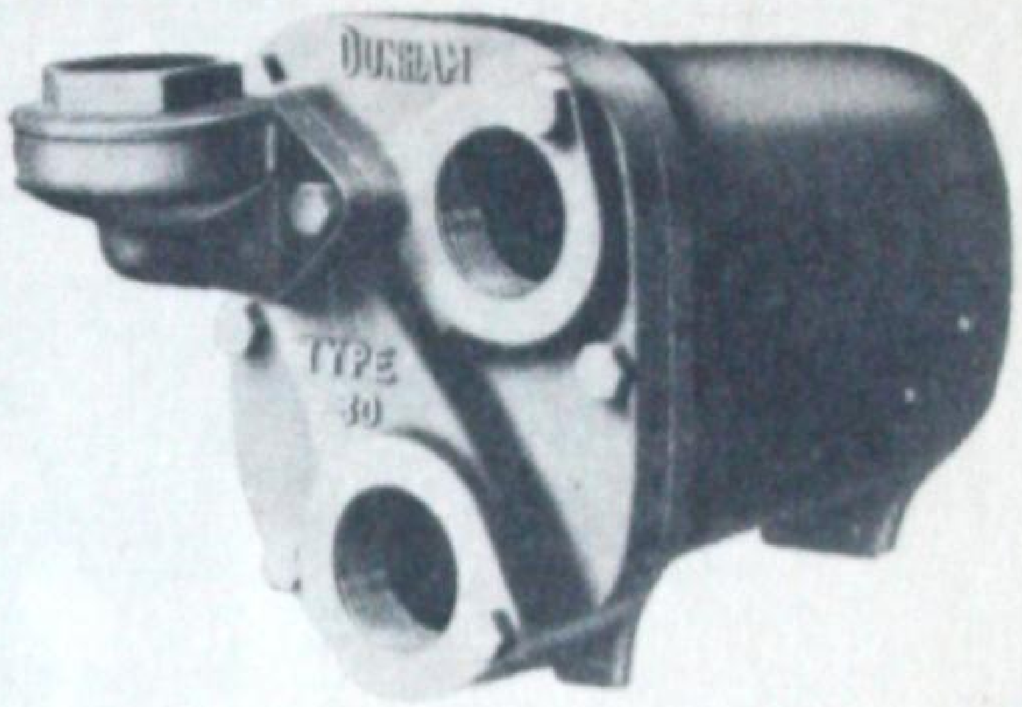
TELEGRAPHIC CODE

Parts	1A or 1B	2B or 2C	3A or 3B
Disc, for 1B, 2C, & 3B Traps only	Atphu	Buphu	Cuphu
Cap, Disc and Gasket	Atphutor	Buphutor	Ciphutor
Gasket	....	Buphut	Ciphut
Nut	Atphutes	Buphutes	Ciphutes
Nipple	Atphutix	Buphutix	Ciphutix

Parts	No. 4A	No. 5A
Cap, Disc, Valve and Gasket	Doburket	Emburket
Gasket	Doburk	Emburk

DUNHAM FLOAT AND THERMOSTATIC TRAP

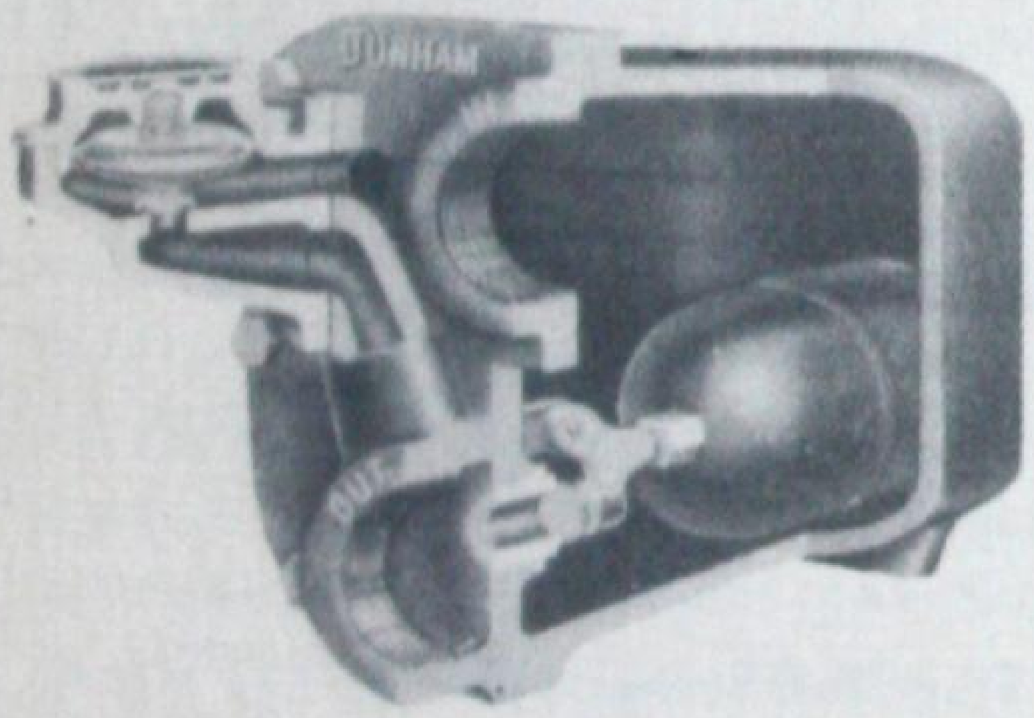
STANDARD — TYPE 30



This Trap combines the principles of the Dunham Thermostatic Trap and a Float Trap. The assembly is designed so that the thermostatic trap can discharge air while the float valve discharges condensate. The thermostatic trap can handle condensate when the rate of condensate returning exceeds the capacity of float valve.

APPLICATION

This Trap is essentially adapted for use on low pressure steam heating systems. It is applied at drip points in piping, such as rises in, or ends of, steam mains. Also, to unit heaters and ventilators, and heating units of large capacity, from which flow a large quantity of condensate during the heating-up period. This Trap handles a large volume of air and a higher ratio of condensate to air than a radiator trap. It shortens the heating-up period by quick release of air and prevents the holding up of condensate in the system, which might cause water hammer.



CONSTRUCTION

The body and cover are cast iron. The brass thermostatic member and the float valve assembly are fastened to the cover. The float is copper. The Trap Body can be readily removed without disturbing connections. The entire assembly is simple and accessible. See section below.

CAPACITIES AND DIMENSIONS

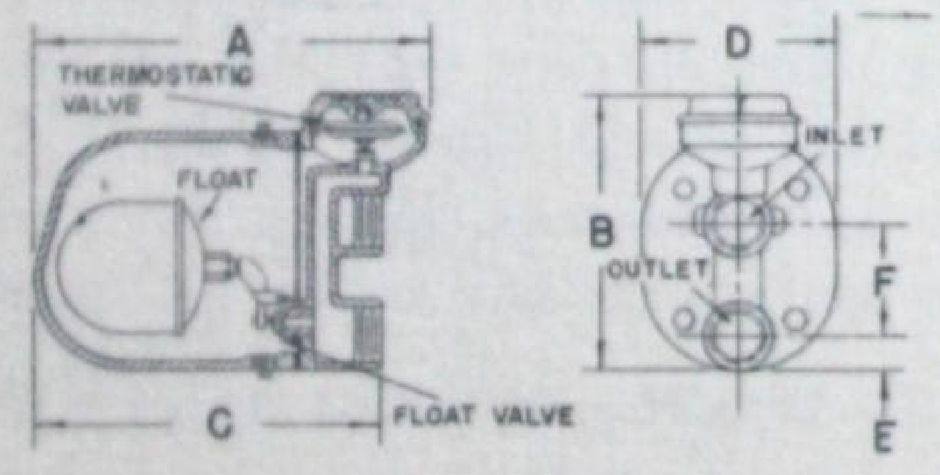


Fig. 3001A—Trap No. 30-2

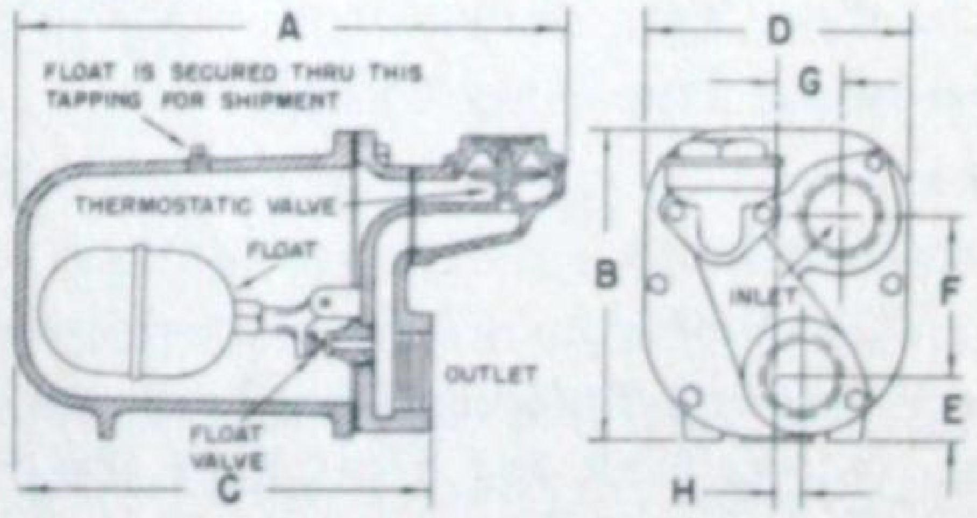


Fig. 2000—Trap Nos. 30-3, 30-4, 30-5 and 30-7

FOR NORMAL OPERATING PRESSURES NOT EXCEEDING 15 POUNDS GAUGE

Max. 15 pounds Min. 15" Vacuum			Capacity sq. ft. E.D.R.	Size Connections Ins.	Net Wgt. Lbs.	Dimensions in Inches							
Size	Catalog No.	Code				A	B	C	D	E	F	G	H
30-2	FT8¾	Bleed	1,500	¾	6½	7¼	5⅛	6 9/32	3½	11/16	2	C.L.*	C.L.*
30-3	FT28¾	Bleary	2,800	¾	16	11⅛	6½	8 7/16	5¼	1¾	3¼	⅞	C.L.*
30-4	FT281	Blemish	4,800	1	16	11⅛	6½	8 7/16	5¼	1⅜	3¼	1 5/16	9/16
30-5	FT481¼	Blest	4,800	1¼	16	11⅛	6½	8 7/16	5¼	1⅜	3¼	1 5/16	9/16
30-7	FT961½	Blithe	9,600	1½	33	14⅛	7⅞	10⅞	7⅞	1½	4 1/16	1 1/16	C.L.*

*C.L. means "On Centre Line".

NOTE

All connections are right hand female tappings.

All traps can be tapped for gauge glass set which can be furnished when specified.

Monel metal thermostatic discs and valves as well as float valves and seats can be furnished on special order.

Orders should specify Catalog No. or Type Number and Size.

Capacities given in the above table are based on a condensation rate of ¼ lb. condensate per square foot of equivalent direct radiation per hour at a pressure differential of 2 lbs. gauge.

TYPICAL CONNECTIONS

The Float and Thermostatic Trap is installed in a horizontal position as shown in typical installation details below. When dripping steam piping, best practice suggests installation with at least 4 feet of pipe, (graded downwards with flow), between it and the point dripped with a scale pocket 10 in. or more deep and never smaller than 2 in. pipe. A gate valve and strainer should be installed in the inlet connection to the trap. The end of a steam main should not extend less than 18 ins. beyond the last connection. When applied to unit heaters, scale pocket connection from heater should be full size of heater return tapping. See detail below.

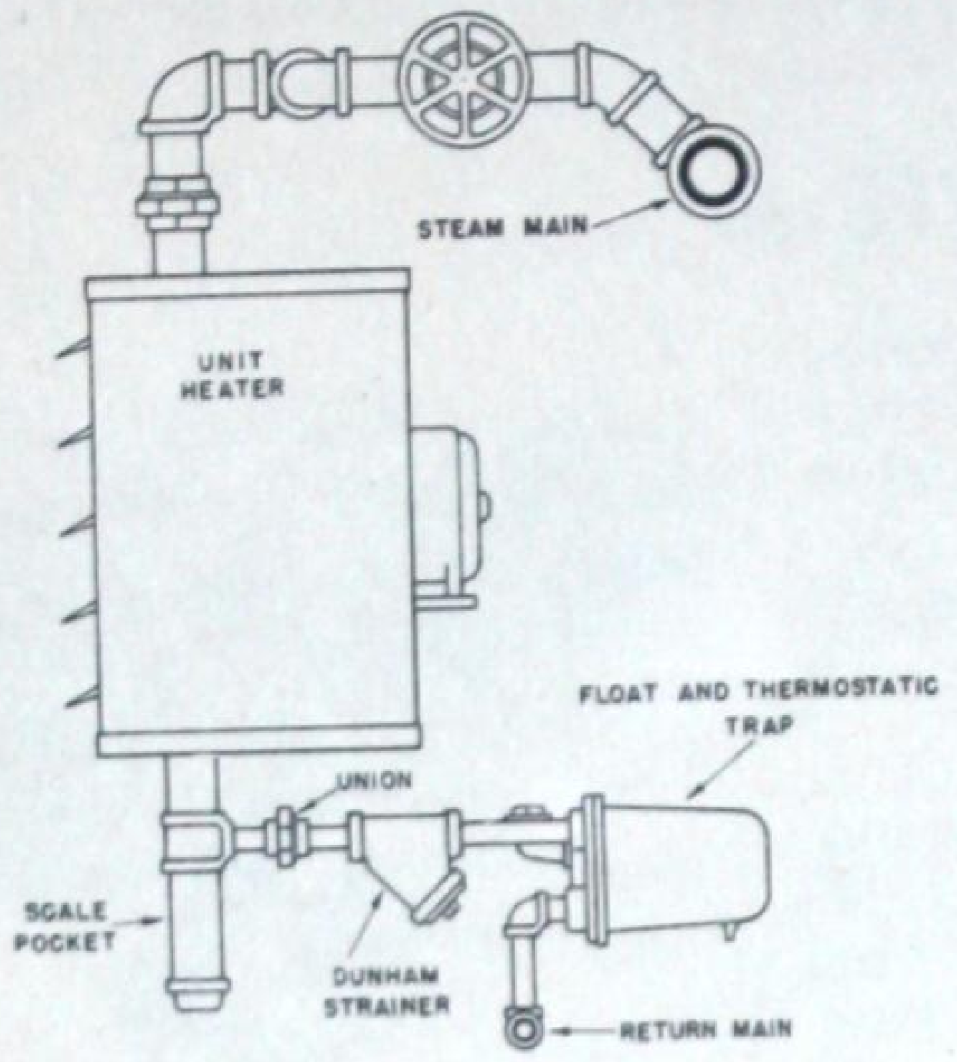


Fig. 3003—Trap Applied to Unit Heater

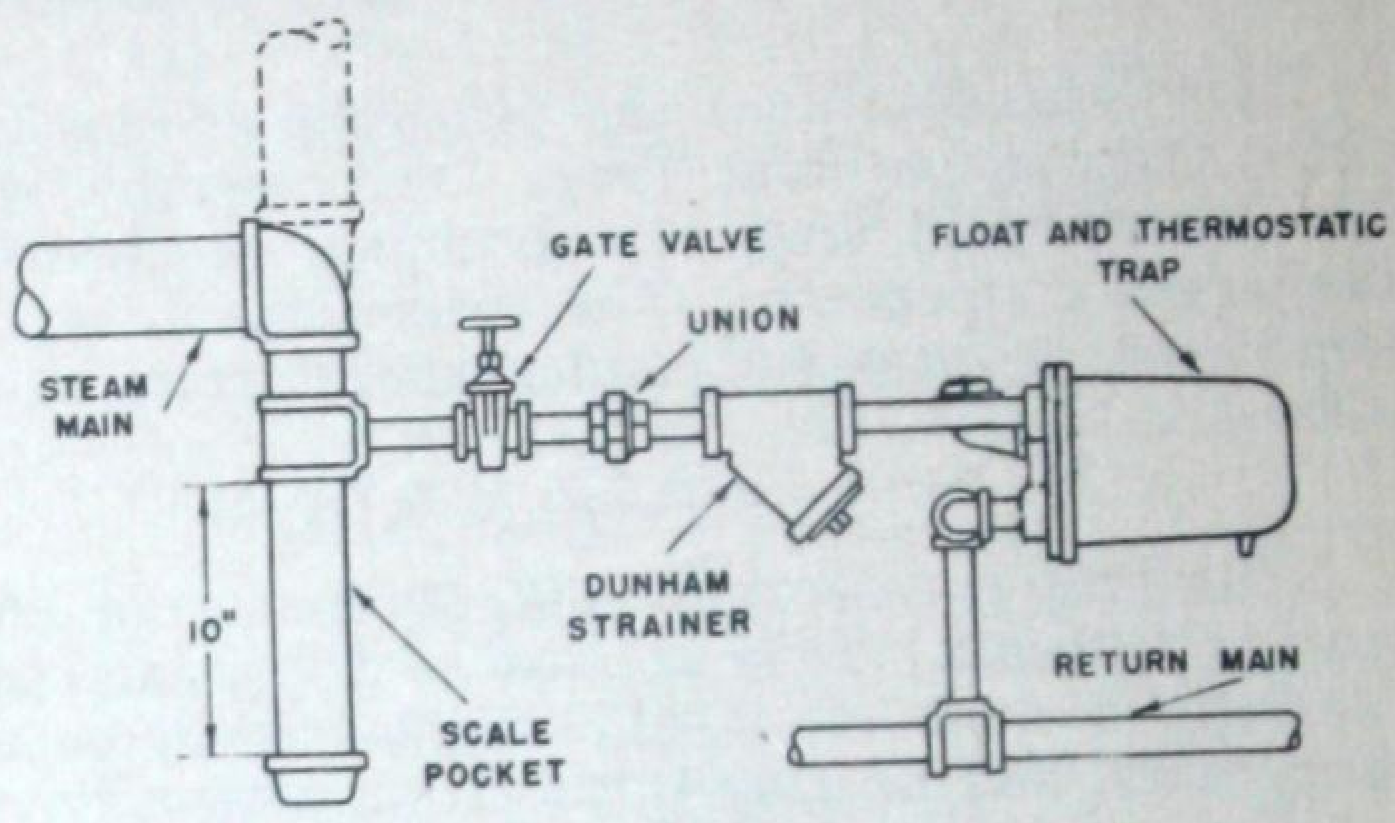


Fig. 3004—Dripping End of Steam Main (or Rise in Steam Main)

PARTS

When ordering parts be sure to give type number and size of trap, also number with letter on thermostatic cover, number and name of part required.

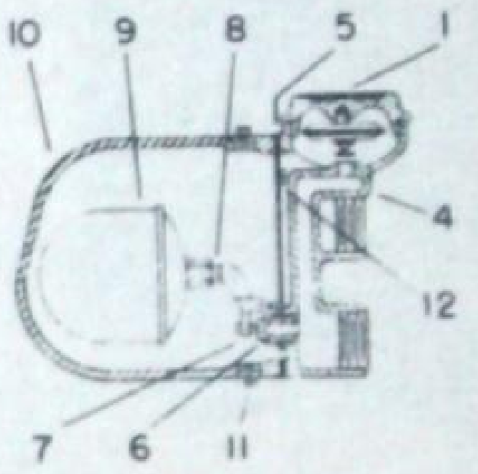


Fig. 3005—Trap Nos. 30-1 and 30-2

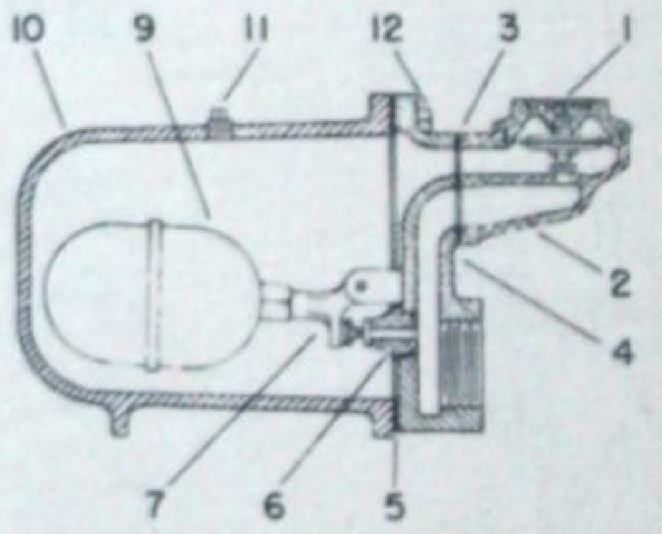


Fig. 2010—Trap Nos. 30-3, 30-4, 30-5 and 30-7

1. Thermostatic Cap and Disc.
2. Thermostatic Trap Body.
3. Thermostatic Trap Body Gasket.
4. Cover.
5. Cover Gasket.
6. Float Valve Seat.
7. Float Valve with Fulcrum Pins, Link and Float Arm Head. Valve, Link and Float Arm Head Assembly are supplied as a unit.
8. Float Arm.
9. Float.
10. Body.
11. Cleanout Plugs.
12. 5/16"—18 x 3/4" Cap Screws.
13. Hanger Hook.

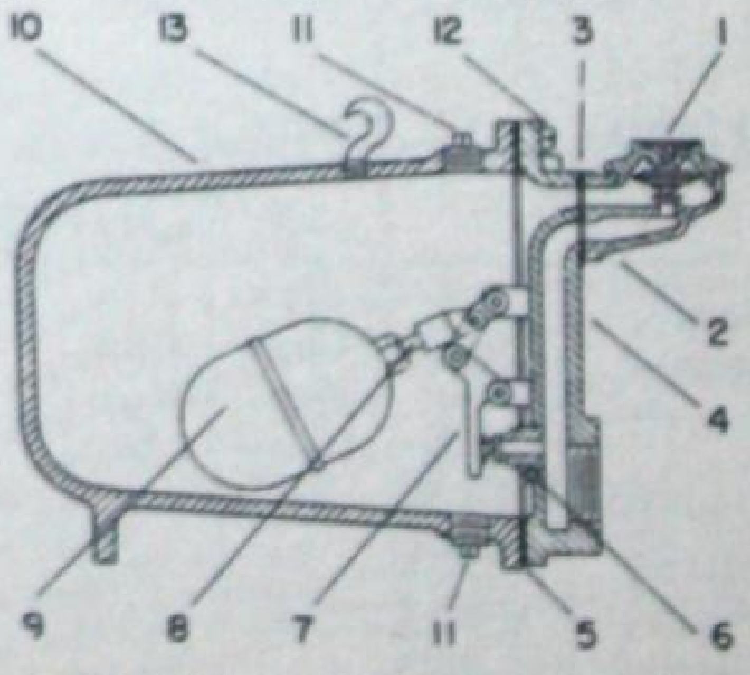


Fig. 3006—Trap No. 30-8

In order that the benefits of continuous improvement in Dunham Products may be made available to the Public without delay, this Company reserves the right to change Specifications and Design without notice.

DUNHAM TH SERIES THERMOSTATIC STEAM TRAPS

FOR WORKING PRESSURES 5 LBS. TO 100 LBS. GAUGE

CONSTRUCTION

These traps are of the thermostatic fluid expansion type, operating in response to the pressure caused by partial vaporization of the liquid within the thermostatic disc. The lateral dimensions of this chamber change with the varying pressure of the vapor caused by contact with entrained gases, steam and water.

The trap consists of two principle parts, a body with renewable valve seat and a cover containing the thermostatic element. The trap is non-adjustable, permanent adjustment for correct operation is built into the thermostatic element.

The bodies and covers as well as the union nut and nipple are brass. The thermostatic element is fabricated from monel metal sheet using a special welding process, and corrugations are designed to reduce the movement at the rim, distributing the disc motion uniformally.

The valve and seat are of special heat treated stainless steel. The spherical valve is swiveled to insure its seating tightly without causing localized stresses on the thermostatic element. The valve opening is exceptionally large and the passage of water and dirt is not obstructed by a guide.

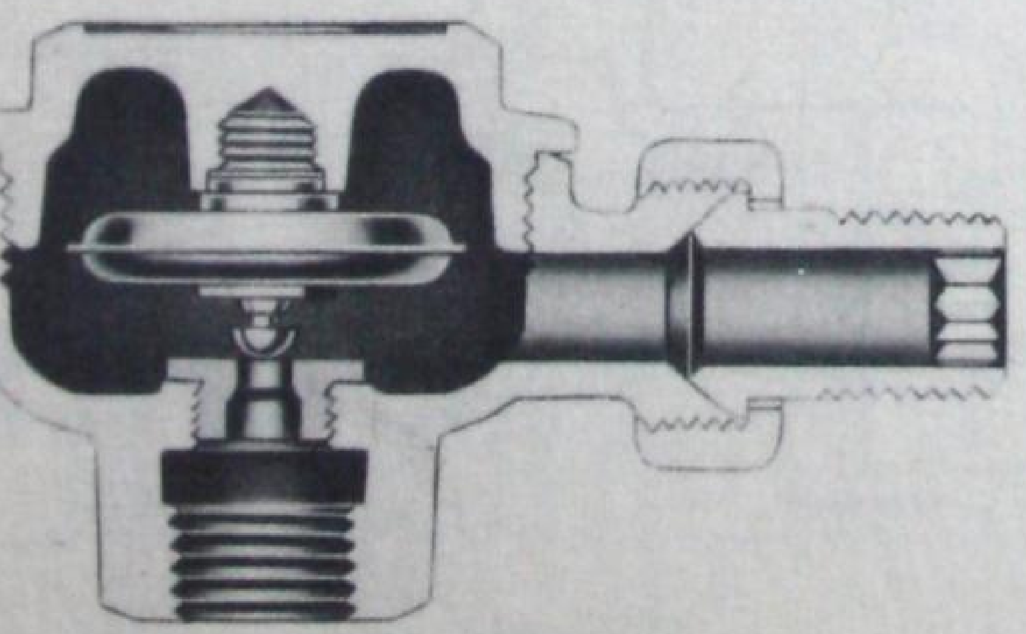


Fig. 3173
Sectional View — Type TH1A Trap

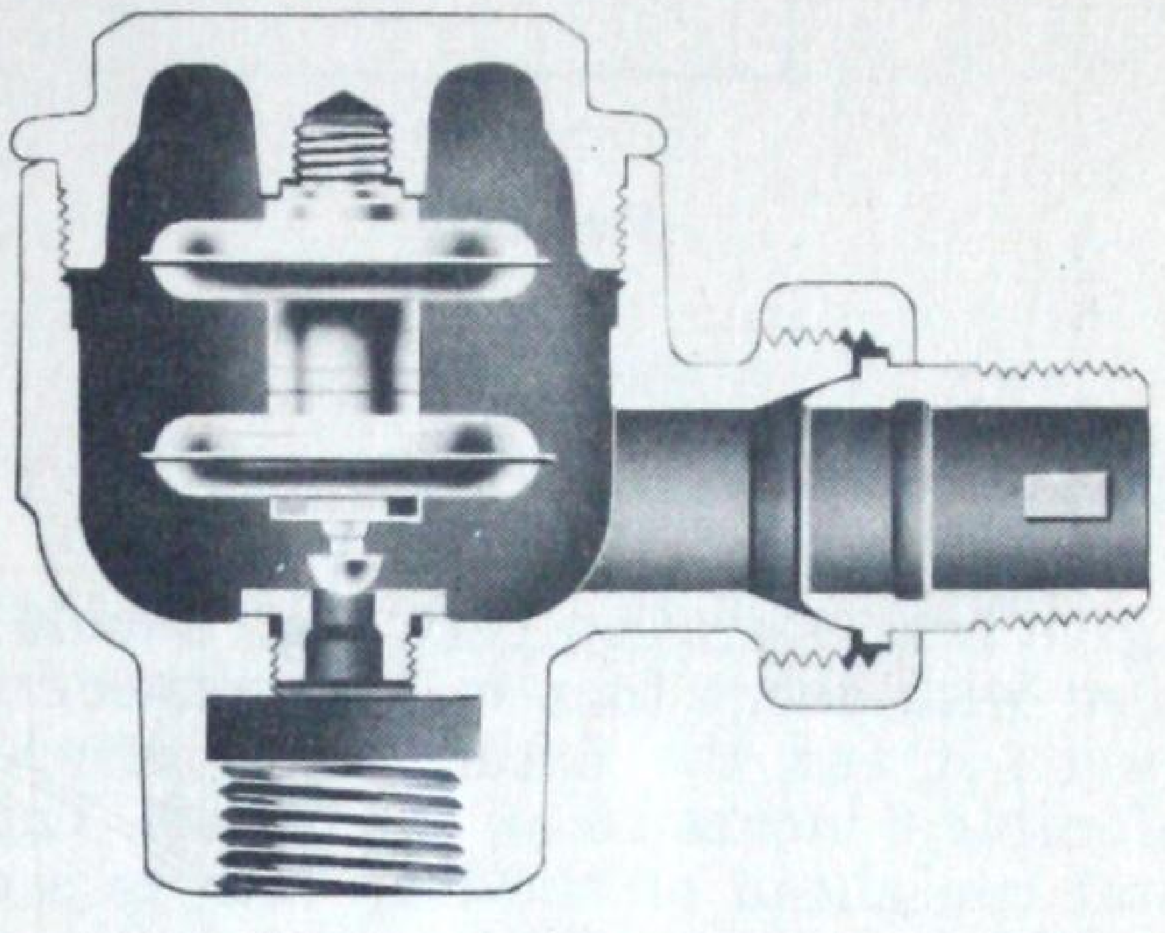


Fig. 3174
Sectional View — Type TH2A and TH3A Trap

The thermostatic elements for traps of the same size are interchangeable without adjustment. Spare element when placed in the trap cover and cover secured to the body, is correctly placed and distanced from the seat. Thermostatic elements may be readily removed for examination without breaking the inlet and outlet piping connections.

CAPACITIES

Capacities based on continuous discharge under average normal operating conditions, namely, at a temperature differential, (difference between temperature of discharging water and that of saturated steam of same pressure as that on the trap) of approximately 5°F.

CAPACITY
POUNDS CONDENSATE PER HOUR

TRAP SIZE	WORKING PRESSURE (Lbs. Per Sq. In. Gage)				
	5	25	35	50	100
TH1A	125	355	445	560	840
TH2A	195	565	700	880	1300
TH3A	290	790	980	1200	1780

ENGINEERING DATA

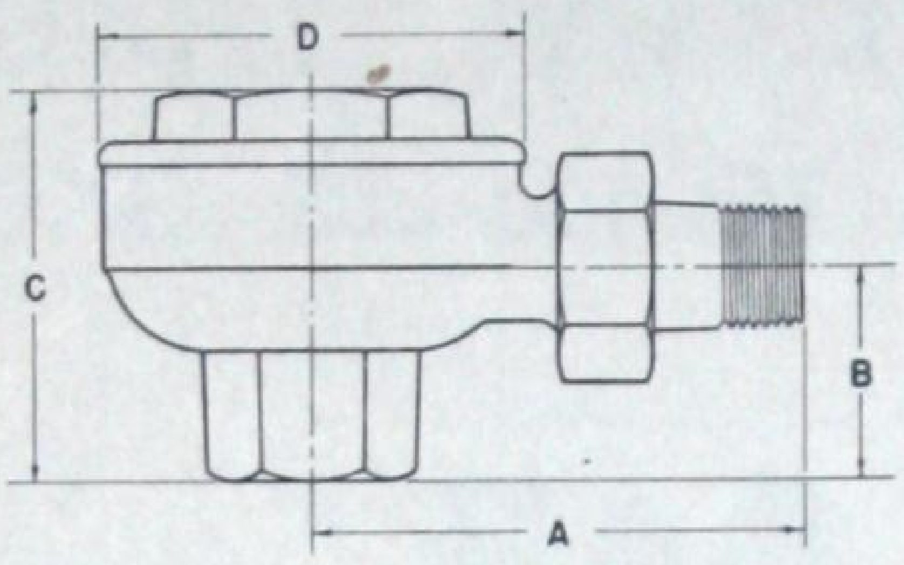


Fig. 3170

DIMENSION TABLE						
Trap Size	Size Conn. Inch.	Net Wgt. Lbs.	Dimensions—Inches			
			A	B	C	D
TH1A	½	2	3¼	1⅜	2⅝	2¾
TH2A	¾	2¾	3⅜	1 9/16	3½	2¾
TH3A	1	3	3½	1¾	3 9/16	2¾

INSTALLATION

To give best operation each trap should be installed with about four feet of connecting pipe between it and the fixture being dripped and preferably 6 inches below the fixture. This horizontal run ahead of the trap acts as a cooling leg which minimizes fluctuations in the rate of trap discharge.

Trap capacities are increased by installing the trap more than 6 inches below the unit being dripped.

It is good practice, though not necessary except in special cases, to install each trap with a by-pass, with valves on either side of trap and in the by-pass as shown in Fig. 836C.

There should be a valve in the steam connection to each fixture and a corresponding valve in the drip connection on the discharge side of the trap. Whenever the steam valve is closed, the drip valve should also be closed thus cutting both fixture and trap out of service.

Where condensation is to be elevated, the trap should be installed at the high point and with a surge chamber between the fixture and trap as shown in Fig. 2030A.

The discharge from the traps may go to an open receiver of a boiler feed pump or an open connection to sewer. It must never be connected into a vacuum return pipe unless provision is made to release the vapor formed when high temperature condensate is subjected to a partial vacuum. Use of a flash tank for this purpose is shown in Fig. 1041B.

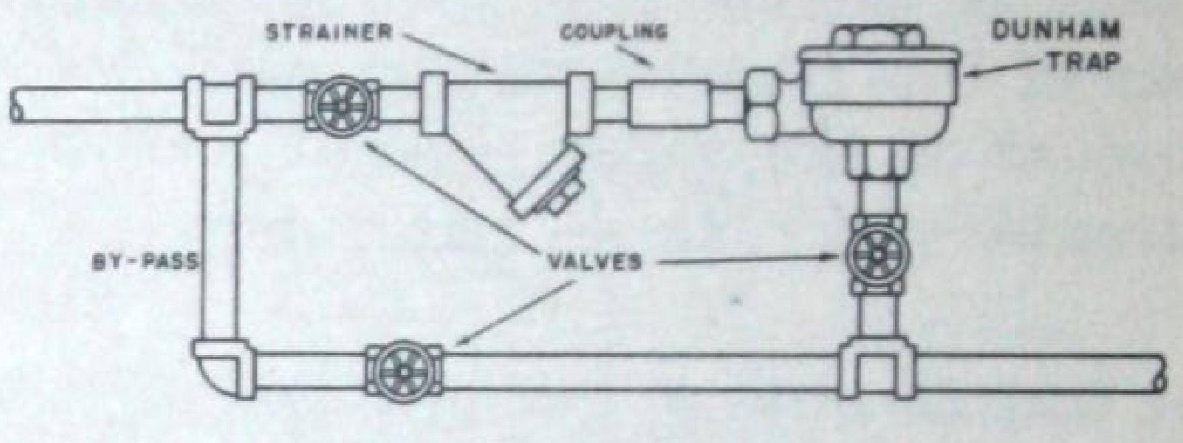


Fig. 836C
Typical installation of a TH Series Trap with a strainer ahead of its inlet and a valved by-pass.

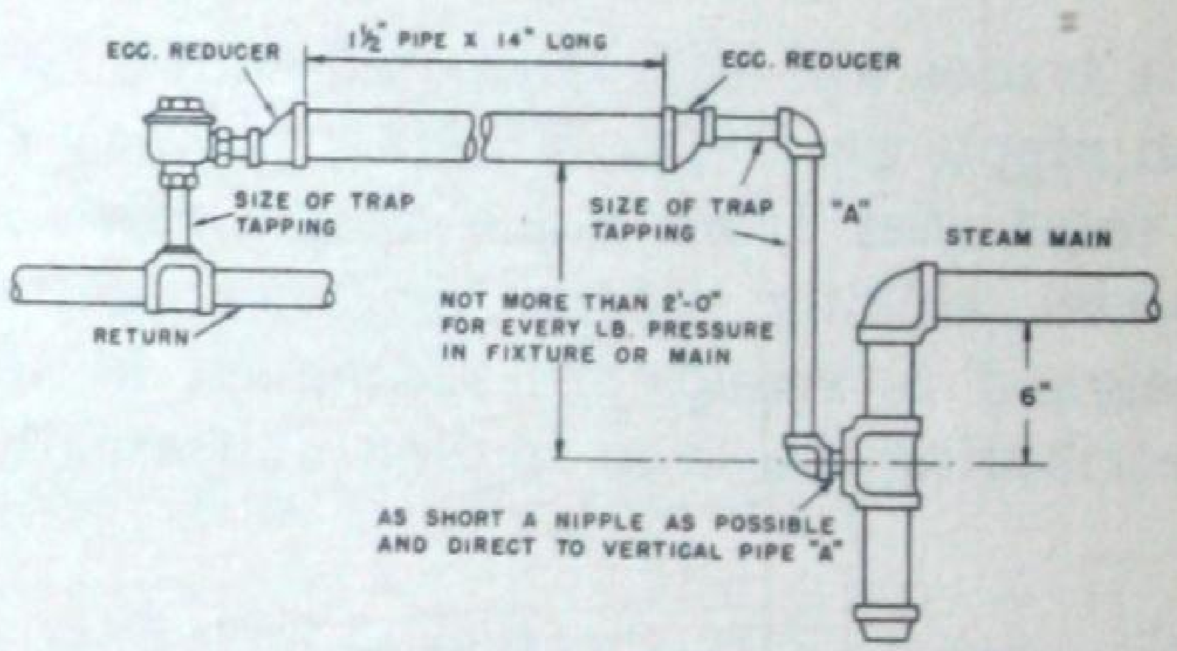

ECC. REDUCER
1½" PIPE X 14" LONG
ECC. REDUCER
SIZE OF TRAP TAPPING
SIZE OF TRAP TAPPING
"A"
STEAM MAIN
RETURN
NOT MORE THAN 2'-0" FOR EVERY LB. PRESSURE IN FIXTURE OR MAIN
6"
AS SHORT A NIPPLE AS POSSIBLE AND DIRECT TO VERTICAL PIPE "A"

Fig. 2030A
Application of TH Series Trap where condensate is to be lifted into a return line above the steam line.

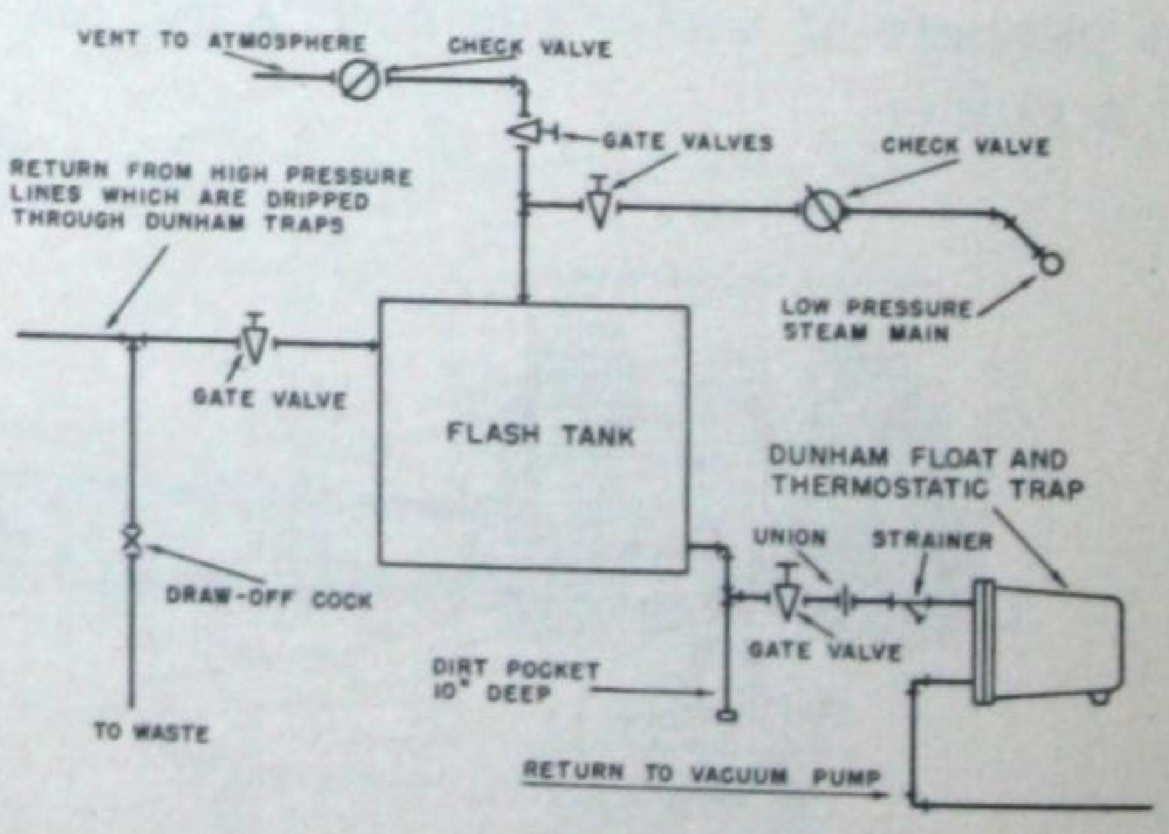


Fig. 1041B
Typical connections for Flash Tank which must be used when returns from medium or high pressure lines are to be connected into a vacuum return line.

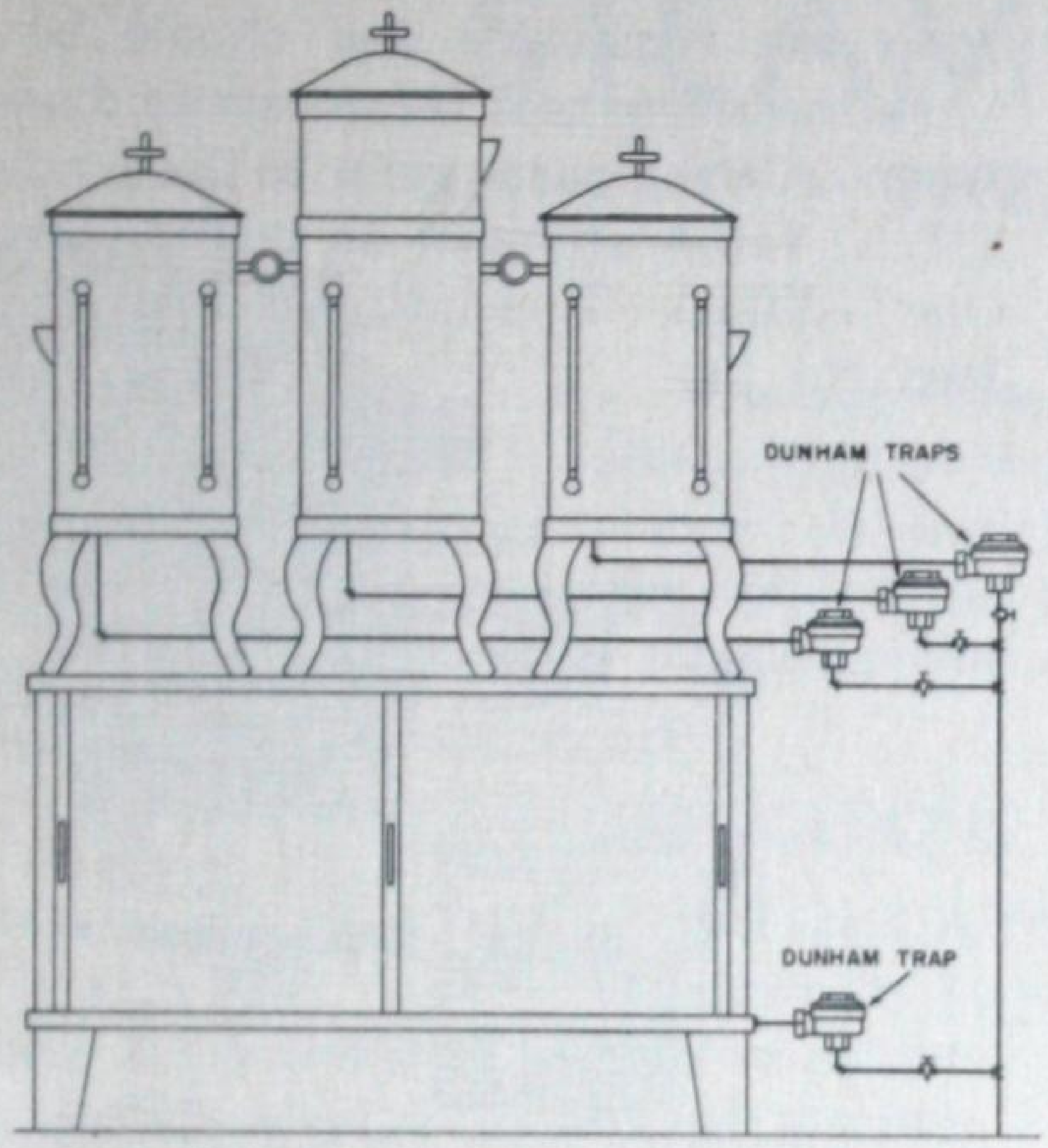


Fig. 833C
Typical application of TH Series Traps to drain and vent individual units of a battery of coffee urns and a dish warming closet.

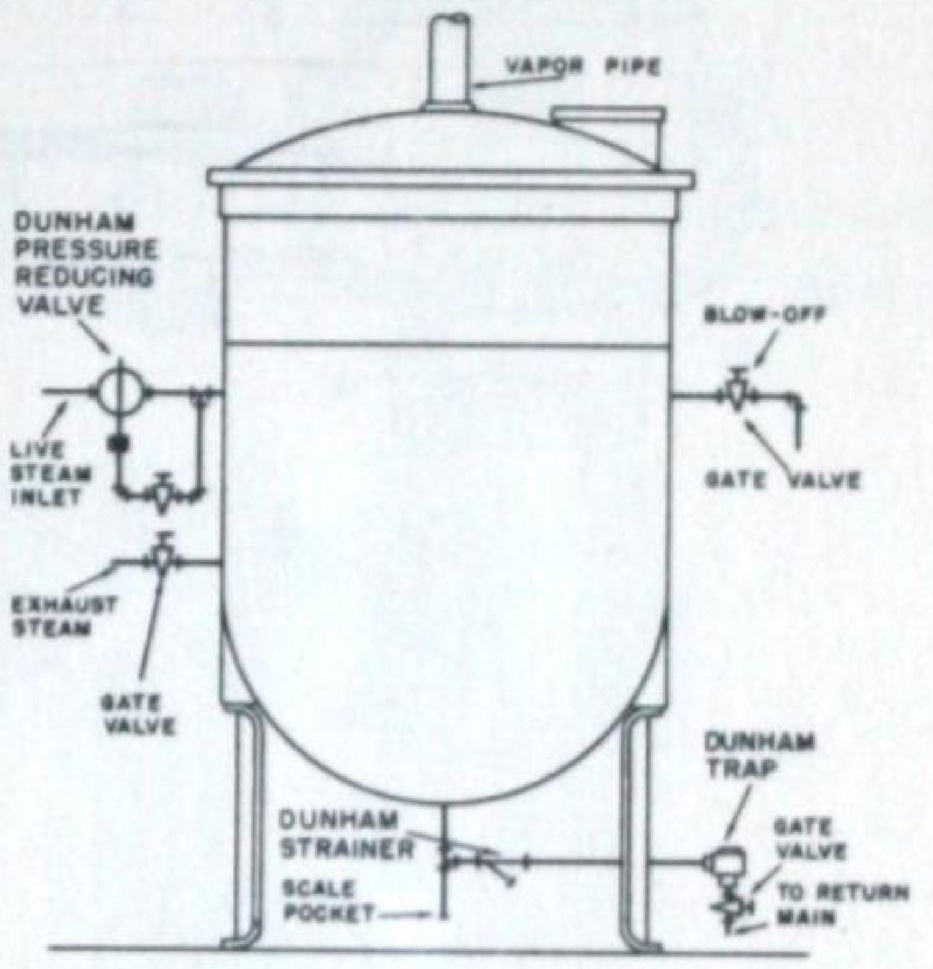


Fig. 980E
A closed jacketed kettle with steam supply pressure governed by a single seated pressure reducing valve. Condensate and air are released by a TH Series Trap.

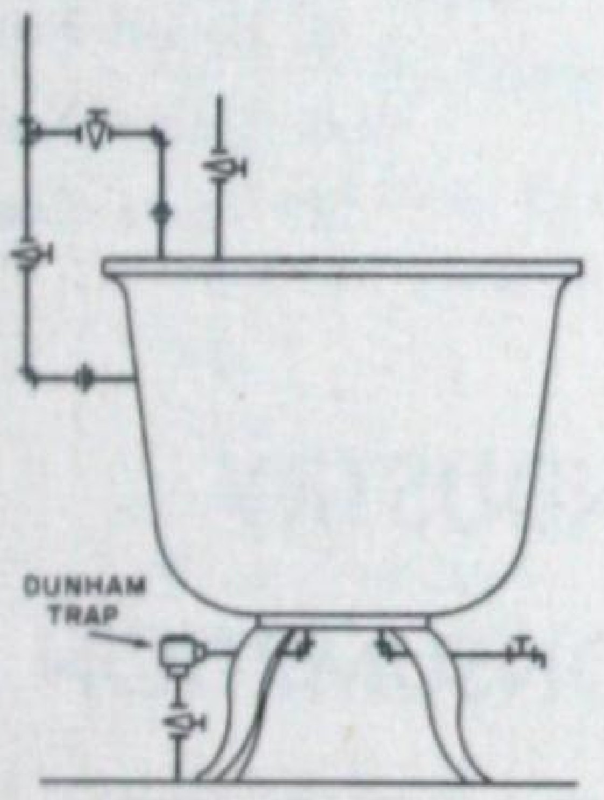


Fig. 835B
Typical application of a TH Series Trap to an open jacketed steam kettle.

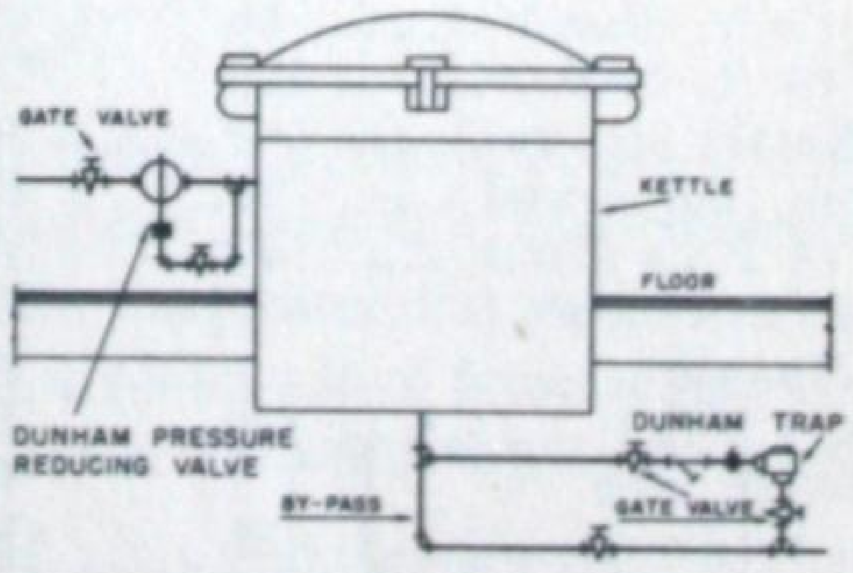


Fig. 979E
Pressure Reducing Valve and TH Series Trap applied to a process kettle. Note the suggested use of a by-pass around the trap.

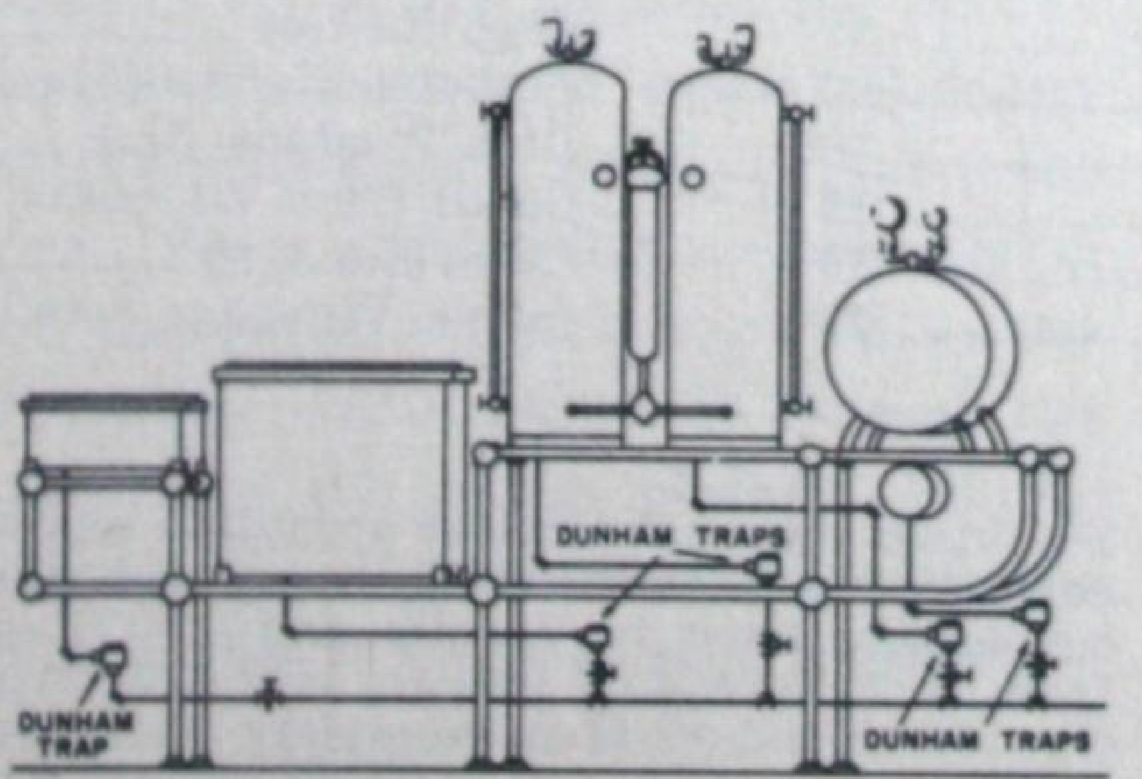


Fig. 834B
Application of TH Series Trap when used on hospital fixtures for the operating room, such as sterilizers and distilling apparatus.

PARTS

Discs are interchangeable in traps of the same size and capacity and are tested under operating conditions at the Factory. They will give proper operating results when installed according to instructions. No setting gauge is necessary.

Seats are removable and should be replaced when installing new thermostatic discs.

When ordering parts, refer to the symbol TH1A, TH2A, TH3A stamped on trap covers. (VIZ—One —TH1A Thermostatic Disc Assembly, Part No. 3).

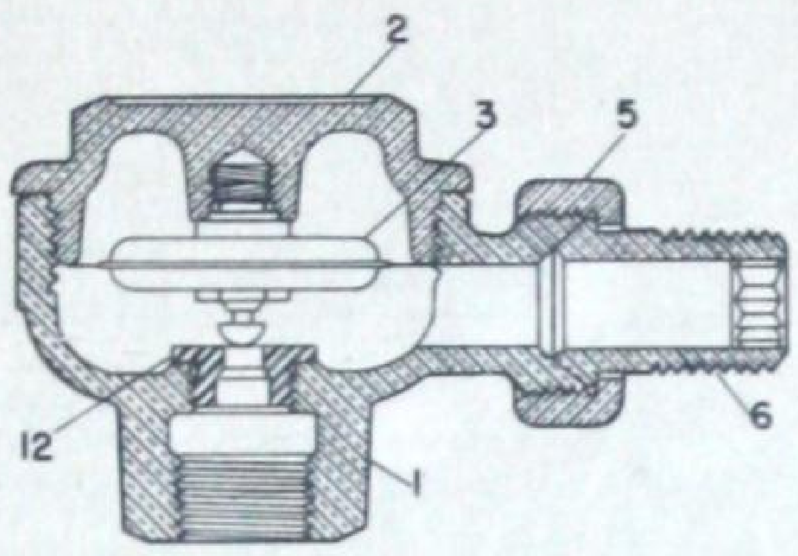


Fig. 3171

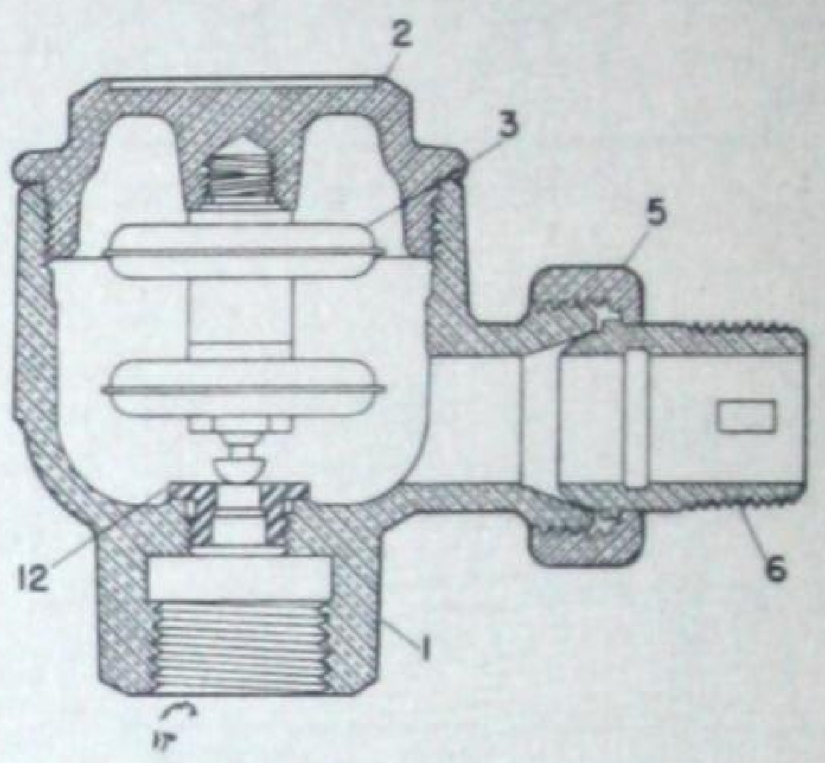


Fig. 3172

1. Body
2. Cap
3. Disc Assembly

5. Union Nut
6. Union Nipple
12. Valve Seat

USING STEAM IN INDUSTRY

APPROXIMATE STEAM CONSUMPTION

LAUNDRY EQUIPMENT

Appliance	Lb. Steam per hour
Washer (3 ft. diam.)	60
Washer (6 ft. diam.)	120
Starch Kettle (50 gal.)	60
Dry Room (per draw)	15
Mangle (4 ft. x 8 ft.)	60
Soap Kettle (50 gal.)	60
Double Mangle (4 ft. x 8 ft.)	120
Cylinder—16 inch (8 ft. long)	30

KITCHEN EQUIPMENT

Appliance	Lb. Steam per hour
Coffee Urn (10 gal.)	34
Coffee Urn (5 gal.)	17
Steam Table per Sq. Ft.	1.7
Bain-Marie per Sq. Ft.	3.4
Vegetable Steamers	40
Stock Kettles	20
Oyster Pots	18
Egg Boilers	18
Warming Ovens	35
Plate Warmers	35

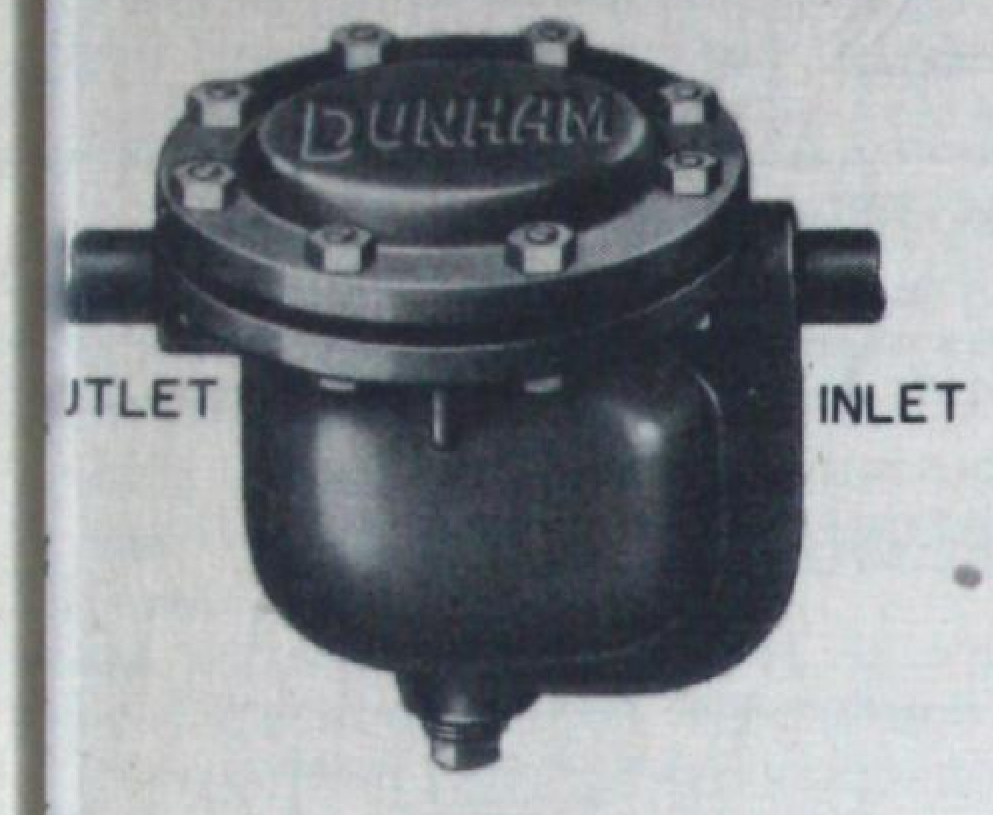
Appliance	Lb. Steam per hour
Sterilizer Battery	90
Dish Washer (single)	30
Hot Water Tanks	30
Potato Boilers	60
Soup Kettles	30
Jacketed Kettle (5 gal.)	15
Dish Washing Sink	30
Small Bean Warmer	15
Chocolate Urn	15
Silver Washing Jets	90

Steam and water consumption by the steam-using equipment of industry can be substantially reduced by the use of a condensation and boiler feed pump instead of wasting condensate. The use of a boiler feed pump increases the capacity of the boiler about 20 per cent above that when cold city water is fed. Fuel consumption drops from 10 to 20%. Water consumption drops as much as 20 to 40% in small laundries, 2 to 5% in dairies. Amount of boiler compounds required drops about 90% and boiler encrustation is reduced.

To obtain the most efficient operation and the maximum capacity from steam-using apparatus, air as well as condensate must be readily and continuously released from each individual process unit. The use of a steam trap on each individual appliance or fixture eliminates difficulties such as air binding or air pocketing and results in increased capacity and efficient performance of the equipment.

DUNHAM HIGH PRESSURE STEAM TRAP

TYPE 81 A



Type 81 A High Pressure Steam Trap

This trap vents air and drains condensate from steam lines, heaters, process appliances and fixtures operating at steam pressures up to 150 pounds. It employs the open inverted bucket principle of operation. The simple design and sturdy construction illustrated in Fig.1562A,give a non-air-binding, self-cleaning, efficient trap.

APPLICATIONS

The Type 81A Trap increases the efficiency of steam transmission and utilization by keeping pipe lines and fixtures free from air and water hich hamper the distribution and use of steam.

It is particularly adapted to drain high pressure ower station steam lines and distributing lines and r service on:

Unit Heaters
Garment Presses
Vulcanizers
Cooking Equip.
Coffee Urns
Steam Tables
Sterilizers
Fertilizer Dryers
Rendering Kettles
Dry Kilns
Hot Water Tanks

Laundry Equip.
Oil Refining Equip.
Blast Coils
Salt and Drug Processing
Paint and Varnish
Soap
Sugar
Tanning
Wood Working
Canning

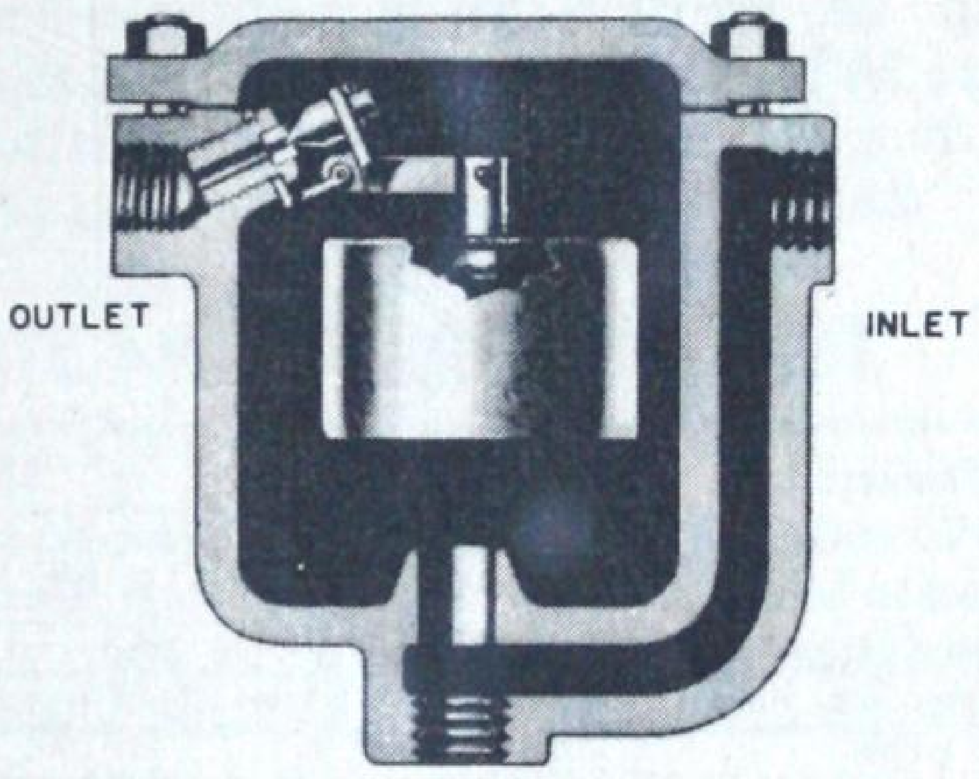


Fig. 1562A
Sectional view of Type 81 Trap

PERATION

Condensation flows into the trap body through he side inlet. As the water rises it traps air and team in the inverted bucket. This gives the bucket uoyancy to rise with the condensate and close the alve by its powerful leverage. As the condensate ontinues to rise, it forces the air from the bucket. t the same time the entrapped steam condenses nd the bucket loses buoyancy, sinks and opens the ischarge valve. The air which has accumulated in he top of the trap is immediately expelled by the ressure of the water which follows it through the rap outlet and into the return piping. As the ondensate recedes, air and steam again enter the nverted bucket to give it the buoyancy to close the alve. This cycle is repeated as long as the trap is alled upon to vent air and water from steam lines r fixtures. The condensate may be discharged to higher levels within the limits of the pressure on the trap—approximately 2 feet for each pound of pressure.

CONSTRUCTION

Simplicity, accessibility, compactness, and long life are features of the Type 81A Trap assembly. The body is of iron; the valve and seat are of heat-treated stainless steel; the bucket is of formed copper and a copper gasket is used between the cover and body.

The removal of the cover exposes the working parts for inspection without disturbing piping connections. Valves and seats can readily be removed and replaced with minimum work. The powerful leverage of the valve mechanism gives positive closing and opening of the valve and the ample travel minimizes wear between valve and seat.

ENGINEERING DATA

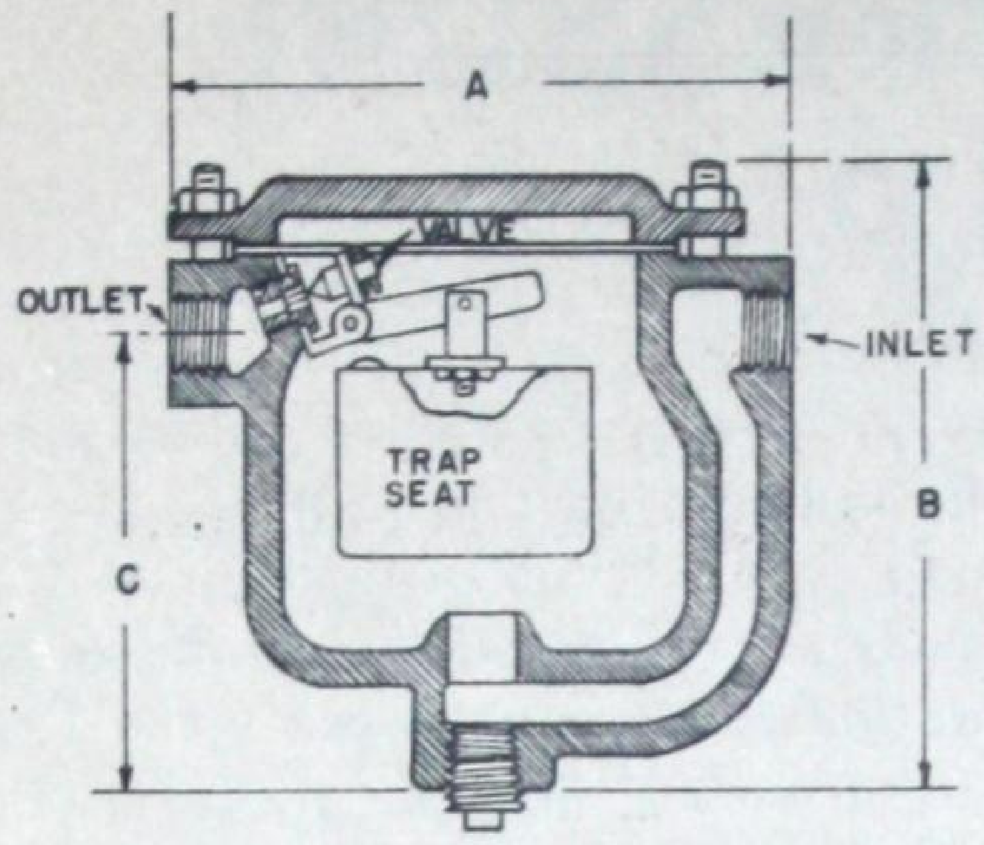


Fig. 1563 A

Size Tappings Inches	Cat. No.	Net Weight Lb.	Code	Dimensions in Inches		
				A	B	C
½	FO½	10½	Buin	6	6	4⅜
¾	FO¾	18¼	Buint	7	7½	5⁹⁄₁₆

NOTES

Connections are right hand female pipe tappings. Trap valves and seats are removable and replaceable. Orders should give Catalog Number or Type Number and size as well as the pressure at the inlet and outlet of the trap.

SELECTING FOR CAPACITIES AND PRESSURES

Type 81 A Traps are equipped with valves and seats for *Maximum Working Pressures* of 10, 20, 40, 80, 125 and 150 pounds gauge as ordered. Type 81 A Traps will operate at any pressure *below the Maximum Working Pressure* stamped on each trap *but will remain closed if pressures are increased materially above this maximum.* It is important therefore that a Trap be selected with a Maximum Working Pressure as high as the extreme pressure differential which may occur in any given application. Orders should state (a) maximum initial pressure, (b) reduced pressure if trap is to discharge against pressure or if condensate is to be lifted, and (c) pounds of condensate to be handled per hour.

The following table lists capacities for the various available valve and seat sizes under various initial pressures and various differentials in pressure through the traps.

It is recommended that traps be selected with capacities at least twice the condensing capacities of the equipment served, and higher where large volumes of air must be handled rapidly.

TYPE 81 A TRAP CAPACITIES IN POUNDS OF CONDENSATE PER HOUR

Pressure Differential between Inlet and Outlet	½" TRAP Seat Size Symbols and Corresponding Maximum Working Pressure						¾" TRAP Seat Size Symbols and Corresponding Maximum Working Pressure					
	K	L	M	N	O	H	M	R	S	T	U	J
Lbs. per Sq. Inch	150 Lbs	125 Lbs	80 Lbs.	40 Lbs.	20 Lbs.	10 Lbs.	150 Lbs	125 Lbs	80 Lbs.	40 Lbs.	20 Lbs.	10 Lbs.
150	260	...	...	...	...	...	590	...	...	...	...	...
125	245	265	...	...	...	...	550	750	...	...	...	...
100	230	245	...	...	...	...	515	700	...	...	...	...
90	220	235	...	...	...	...	495	675	...	...	...	...
80	210	220	475	...	...	...	475	645	1065	...	...	...
70	200	215	455	...	...	...	455	620	1025	...	...	...
60	195	205	430	...	...	...	435	590	935	...	...	...
50	180	190	405	...	...	...	410	555	915	...	...	...
40	175	185	390	695	...	...	390	515	875	1560	...	...
30	150	165	340	610	...	...	345	470	775	1370	...	...
20	135	145	300	535	835	...	300	410	675	1200	1640	...
15	...	133	280	500	780	...	...	380	630	1125	1530	...
10	...	...	240	425	610	705	...	...	535	955	1300	1700
5	...	...	195	345	540	575	...	...	...	780	1060	1385
2	...	...	...	260	400	420	...	...	...	570	780	920
1	...	...	...	200	315	335	...	...	...	365	620	810

The foregoing capacities in pounds condensate per hour are based on full time discharge with differential in pressure as indicated in left hand column.

PARTS

When ordering parts of Type 81 A Traps always give the type number, size of trap tappings and the inlet and outlet pressures. Parts 4, 5, 6, 7, 8, 9, 11 and 15 are supplied as a unit.

1. Cover
2. Body
3. Bucket
4. Knuckle Joint Rod
5. Knuckle Joint
6. Lever
7. Hinge
8. Hinge Rod
9. Valve
10. Seat
11. Cotter Pin
12. Gasket
13. Machine Bolts and Nuts
14. Knuckle Joint Washer
15. Knuckle Joint Nut
16. Plug

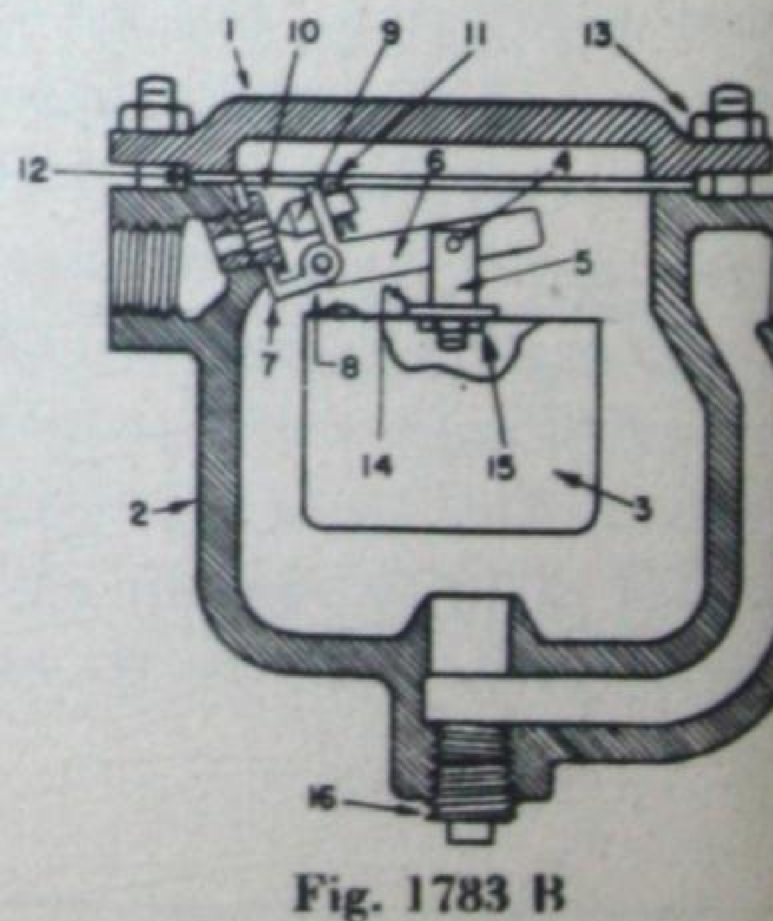


Fig. 1783 B

INSTALLATION

The importance of correct installation cannot be over-emphasized because no high pressure steam trap of the inverted open bucket type can operate either effectively or without excessive wear unless installation permits condensate to create the water seal essential for proper operation. Installation instructions are included in every trap shipment.

Each radiator, coil, kettle or other unit to be drained should be equipped with a separate trap. It is not recommended that one trap of large capacity be used to drain several units. The use of a trap for each fixture eliminates the possibility of steam short-circuiting to cause air-binding and uneven heating of the fixtures.

Each trap should be installed with the top of the trap at least 6 inches below the steam-heated unit or line to be drained, permitting gravity drainage of condensate to the trap and increasing its capacity by the static head of condensate in the "water leg" connection. This standard method of installation is shown in Fig.2089A.Departures from this standard such as the installation of the trap above the outlet of the fixture being drained are to be avoided. Where unavoidable, special installation instructions should be obtained from the Engineering Department.

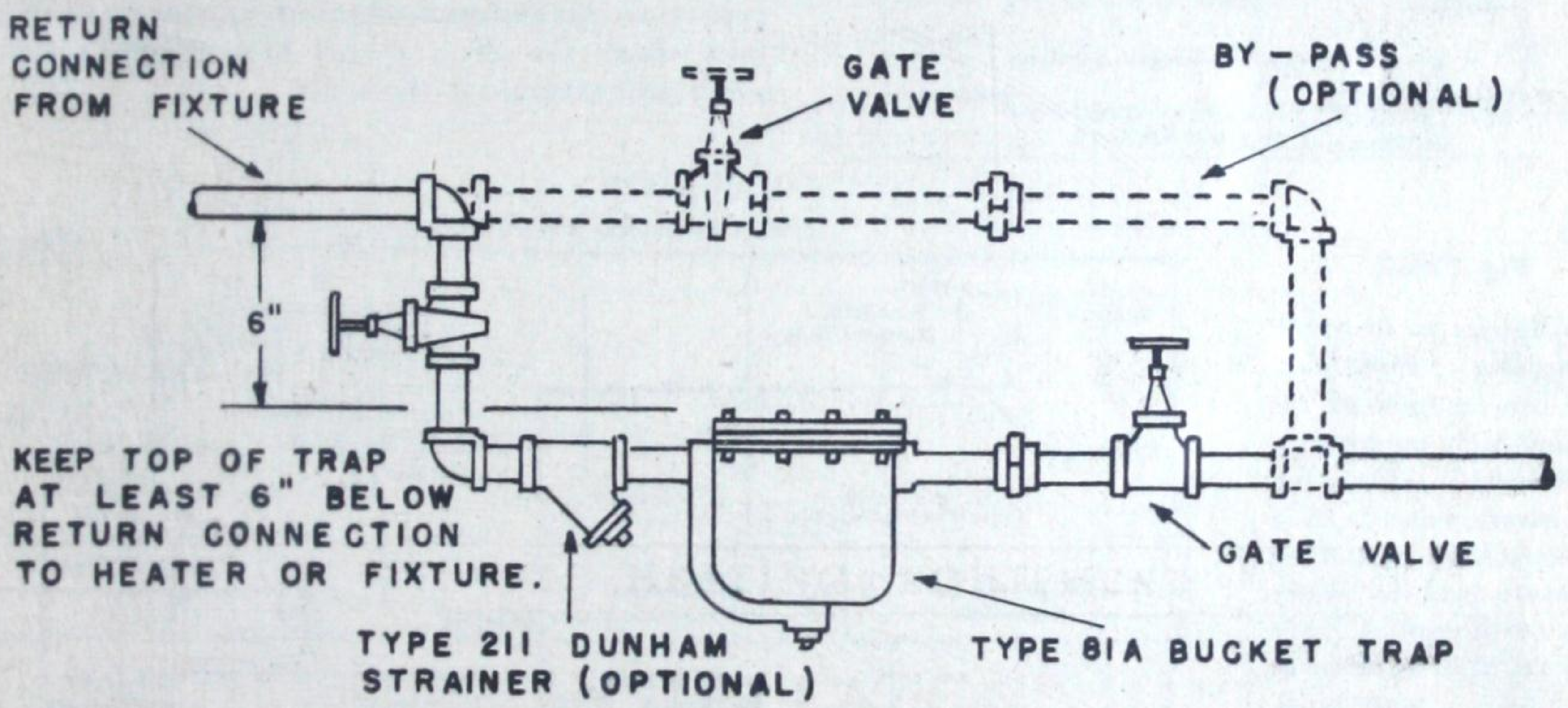
It is desirable to install the trap close to the unit being drained. A long pipe between the unit and trap may cause air-binding. Where such a long connection cannot be avoided, an additional vertical line is used. The Engineering Department will supply installation diagrams for such special conditions.

The use of a by-pass around the trap is optional. Where continuity of service is essential, the by-pass is necessary as the by-pass valve can be opened and the lines or units drained temporarily during trap inspection or repair. On applications where the service is not continuous, the by-pass may be eliminated. By-pass valves left open accidently may be costly in terms of wasted steam.

The use of a Strainer ahead of the trap is also optional but is strongly recommended where dirt, sludge and scale conditions are likely to be encountered. The steam lines should be thoroughly blown or cleaned out before the trap is put into service to remove sediment, scale or other foreign matter. The trap should be filled with water before being put in service.

On applications where the steam pressure is not maintained on the piping or fixture continuously, it is desirable to install a check valve at the trap inlet. A check valve prevents water being drawn back into the fixture as a result of the induced vacuum created by condensation when the steam supply is shut off. It is important to install the trap so that the water seal can neither be broken nor vaporized as loss of prime may cause trap to blow steam.

Each trap is stamped with its maximum operating steam pressure and is fitted with a valve and seat for this pressure. Each trap installed should have a maximum operating pressure rating at least equal to and preferably greater than the maximum pressure used in the fixture or pipe line drained. The application of a trap to operate at pressures above that for which it is stamped may result in inefficient operation of the unit.


RETURN CONNECTION FROM FIXTURE
GATE VALVE
BY - PASS (OPTIONAL)
6"
KEEP TOP OF TRAP AT LEAST 6" BELOW RETURN CONNECTION TO HEATER OR FIXTURE.
GATE VALVE
TYPE 211 DUNHAM STRAINER (OPTIONAL)
TYPE 81A BUCKET TRAP

Typical installation connections for Type 81A Trap

TYPICAL APPLICATIONS

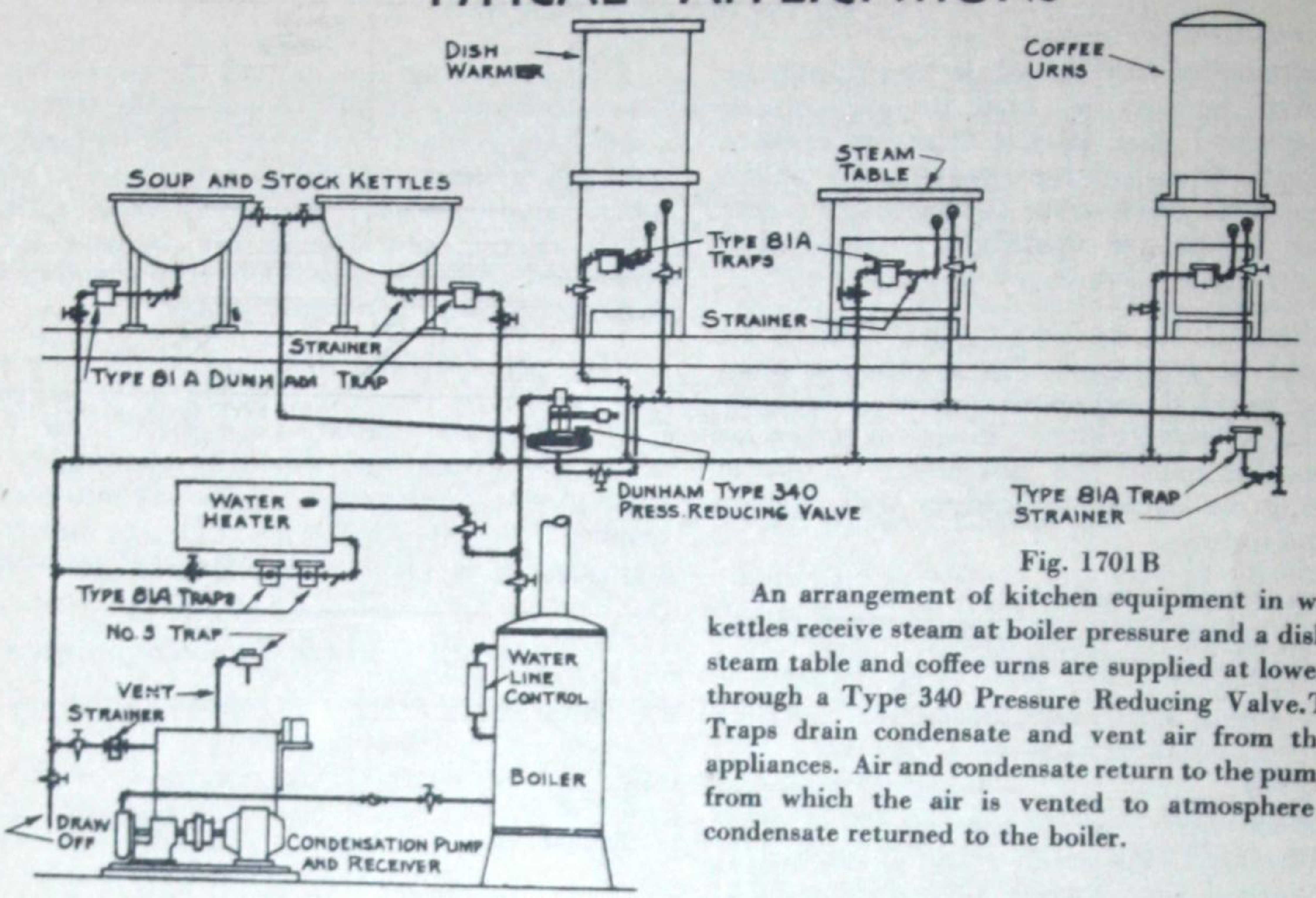


Fig. 1701 B

An arrangement of kitchen equipment in which soup kettles receive steam at boiler pressure and a dish warmer, steam table and coffee urns are supplied at lower pressure through a Type 340 Pressure Reducing Valve. Type 81A Traps drain condensate and vent air from the various appliances. Air and condensate return to the pump receiver from which the air is vented to atmosphere and the condensate returned to the boiler.

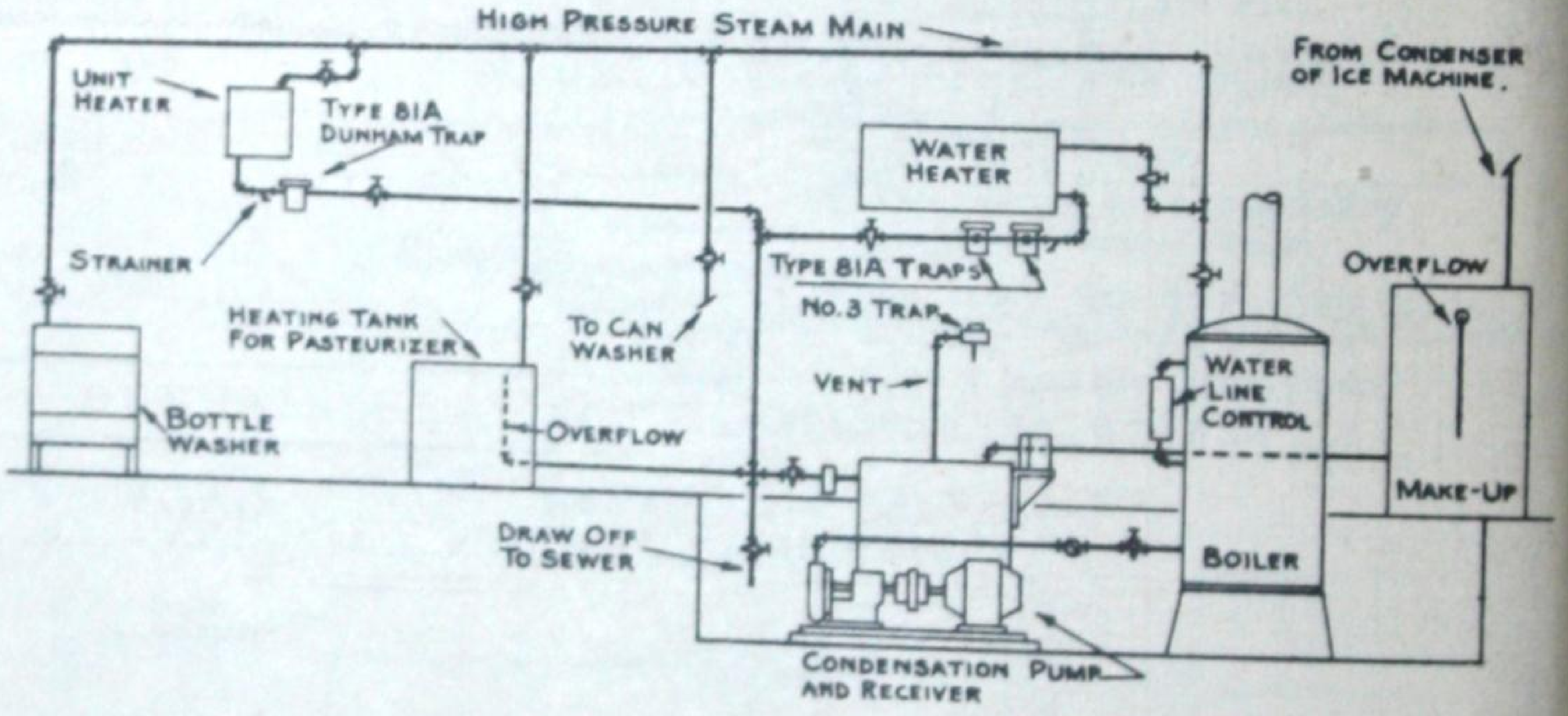


Fig. 1704 B

In dairies as in other steam-using industries waste can be reduced by trapping such equipment as heating tanks for pasteurizers, water heaters unit heaters and pumping condensate back to boilers. Where two Type 81A Traps are installed in battery, as shown here, both must be at exactly the same level.

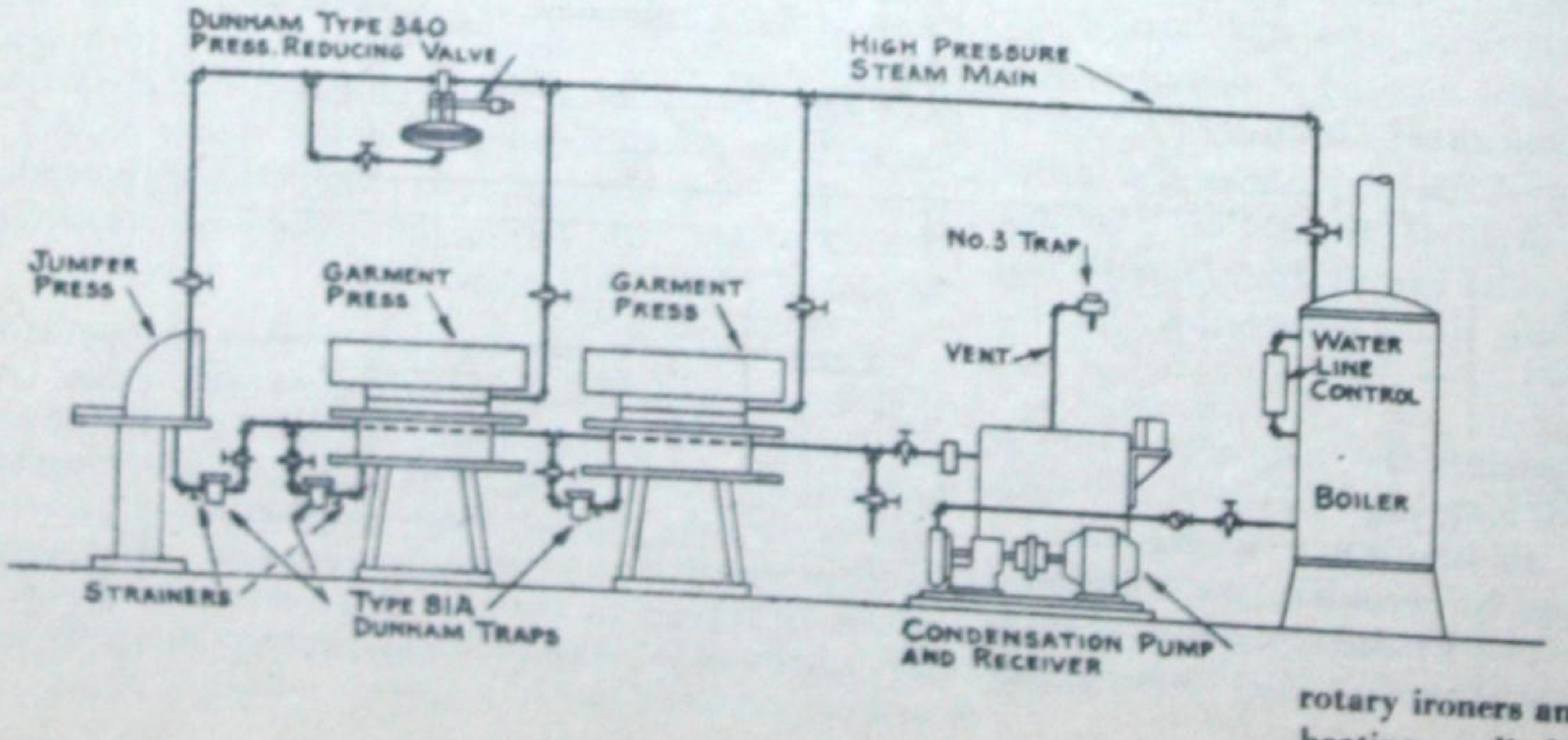


Fig. 1703 B

Pressing and cleaning equipment operates most satisfactorily when steam is supplied at the proper pressure, individual appliances are properly trapped and condensate is positively returned to the boiler. A typical efficient installation of garment and jumper presses is illustrated. Pressure relief valves should be installed in the steam lines to equipment such as rotary ironers and calenders having closed heating cylinders to prevent pressures building up above safe limits of apparatus.

DUNHAM RADIATOR VALVES

TYPE 140 AND TYPE 1140 SERIES BELLOWS PACKLESS

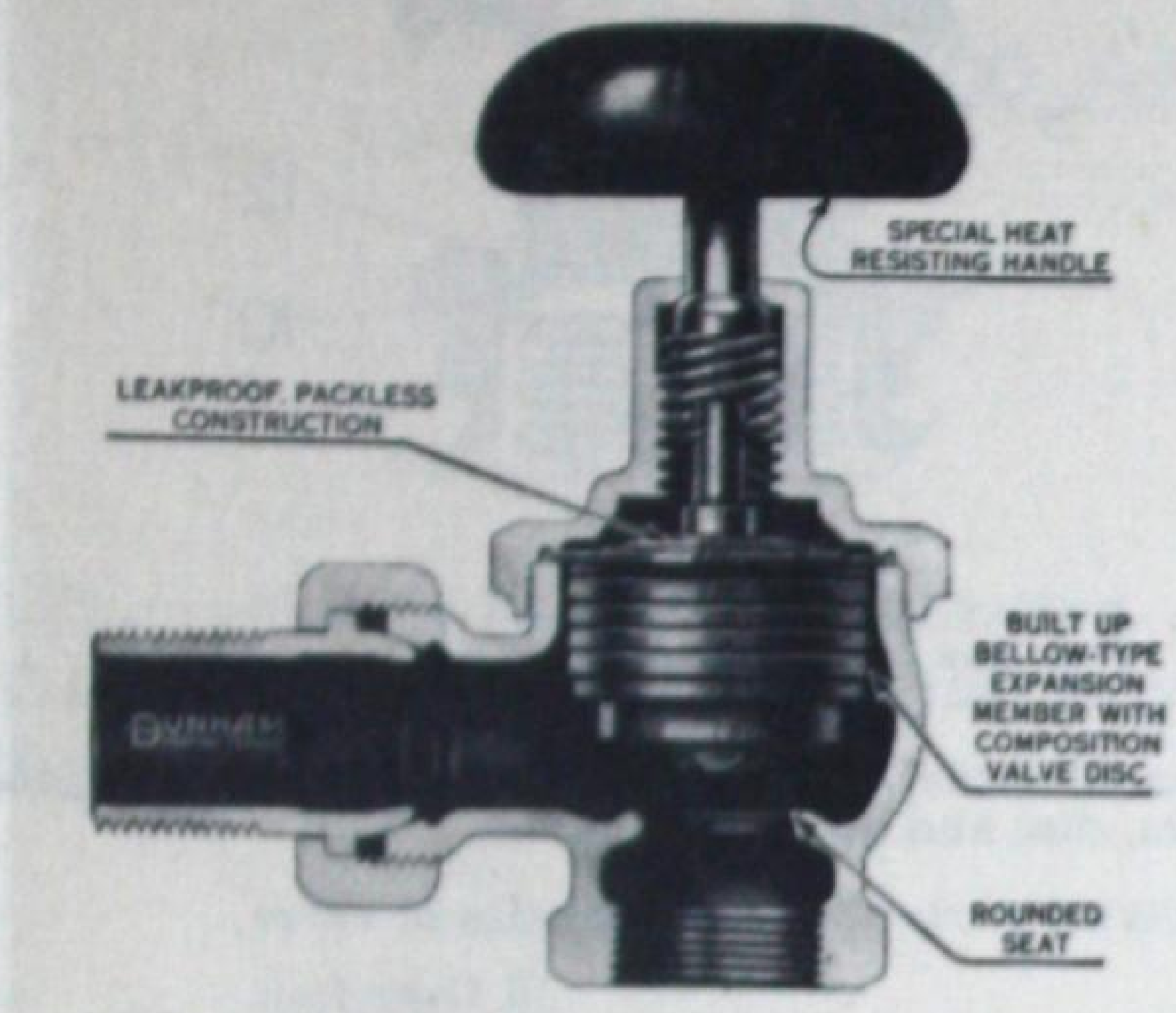

SPECIAL HEAT RESISTING HANDLE
LEAKPROOF PACKLESS CONSTRUCTION
BUILT UP BELLOW-TYPE EXPANSION MEMBER WITH COMPOSITION VALVE DISC
ROUNDED SEAT
DUNHAM

Fig. 877D—Section view of Type 140 Wheel Handle Radiator Valve

This valve is suitable for all types of steam heating systems and for pressures up to 15 pounds.

The valve will be supplied upon order, with a ⅛" weep hole through valve seat for applications in which short down feed risers are dripped through the valve into the radiator.

The body is of bronze. The expansion member of tinned phosphor bronze gives maximum resiliency and wear. The inner valve is equipped with highest quality composition disc, renewable and readily replaceable by removing the bonnet. All parts are interchangeable for the same size of valve. The packless expansion member not only prevents leakage of steam, air or water, but also prevents steam, water or dirt coming in contact with the thread of the valve spindle to cause corrosion or clogging. The handle thus turns easily at all times.

Lock and shield equipment will be substituted for wheel handle on order.

Type 140 series valves are available in ½", ¾" and 1" sizes.

Type 1140 series valves are available in 1¼" and 1½" sizes.

Construction of both valves are identical with the exception of the bonnet assembly.

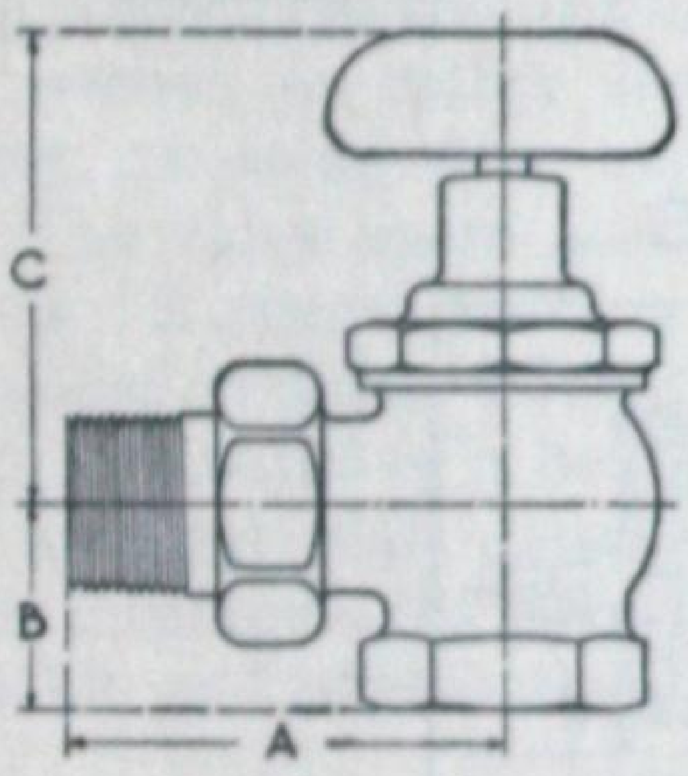
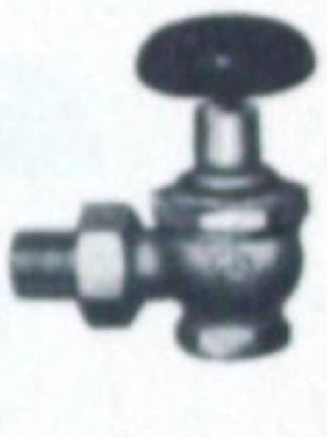


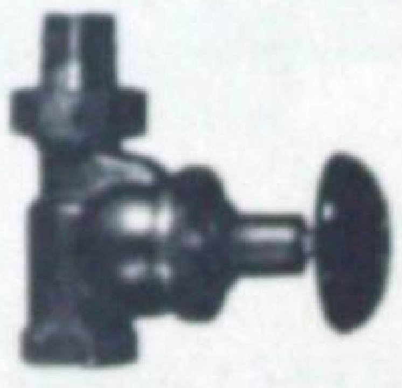
Fig. 921B
Type 140 and 1140 Angle Pattern

DIMENSIONS FOR 140 SERIES VALVES
For Right Hand and Left Hand pattern Valves use same dimensions

Size In.	Type	Cat. No.	Net Wgt. Lb.	Dimensions in Inches				
				A	B	C	D	E
½	140	BW ½-A	1⅝	3⅛	1⅛	3⅝	⅝	1⅝
	142	BW ½-R	1¾	3⅛	1⅛	3⅝	⅝	1⅝
	143	BW ½-L	1¾	3⅛	1⅛	3⅝	⅝	1⅝
	146	BW ½-SN	1¾	2¾	......	4⅛	......	1⅝
¾	140	BW ¾-A	1¾	2⅞	1¼	3¾	¾	1⅝
	142	BW ¾-R	2	2⅞	1¼	3¾	¾	1⅝
	143	BW ¾-L	2	2⅞	1¼	3¾	¾	1⅝
	146	BW ¾-SN	2	3⅛	......	4⅝	......	1⅝
1	140	BW 1-A	2¼	3	1½	3⅞	1	1⅞
	142	BW 1-R	2¾	3	1½	3⅞	1	1⅞
	143	BW 1 L	2¾	3	1½	3⅞	1	1⅞
	146	BW 1-SN	2¾	3⅝	......	5⅛	......	1⅞



Angle



Straightway Non-Offset

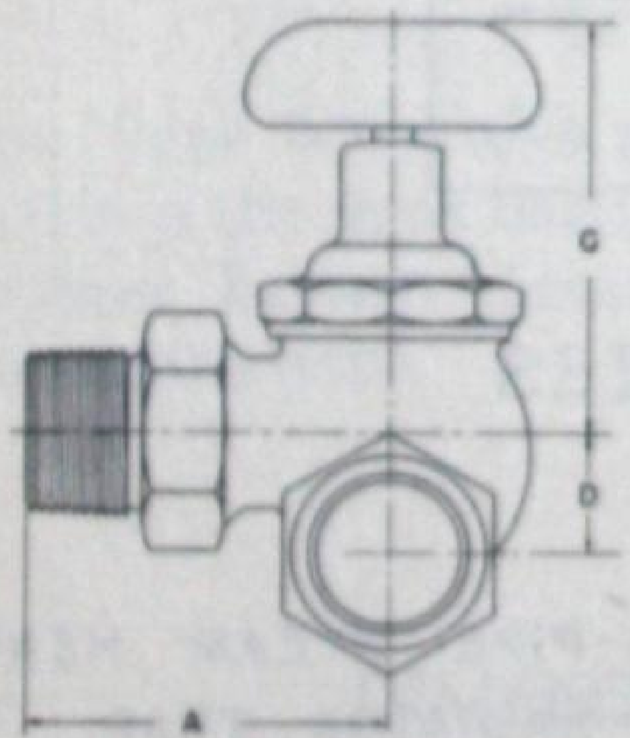


Fig. 3145
Type 142, 143 and 1142, 1143
Left hand corner pattern
Right hand corner pattern similar

DIMENSIONS FOR 1140 SERIES VALVES
For Right Hand and Left Hand pattern Valves use same dimensions

Size In.	Type	Cat. No.	Net Wgt. Lb.	Dimensions in Inches				
				A	B	C	D	E
1¼	1140 1142 1143 1146	BNW 1¼-A BNW 1¼-R BNW 1¼-L BNW 1¼-S	3¼ 3¾ 3¾ 3¾	3½	1⅝	3⅝	1⅛	2⅜
1½	1140 1142 1143 1146	BNW 1½-A BNW 1½-R BNW 1½-L BNW 1½-S	4¼ 4¾ 4¾ 4¾	3¾	1⅞	3¾	1¼	2⅝

Valves have rough finished bodies.
Specify catalogue number or type number and size on order.

Right Hand

Size Inches	TELEGRAPHIC CODES			
	Type 140 Valve Series			
	Angle Type 140	Straightway Type 146	Right Hand Type 142	Left Hand Type 143
½ ¾ 1	Antawny Antepid Antidal	Snotawny Snotepid Snotidal	Ritawny Ritepid Ritidal	Letawny Letepid Letidal
	Type 1140 Valve Series			
	Angle Type 1140	Straightway Type 1146	Right Hand Type 1142	Left Hand Type 1143
1¼ 1½	Apwpo Apwpu	Stwpo Stwpu	Riwpo Riwpu	Lhwpo Lhwpu

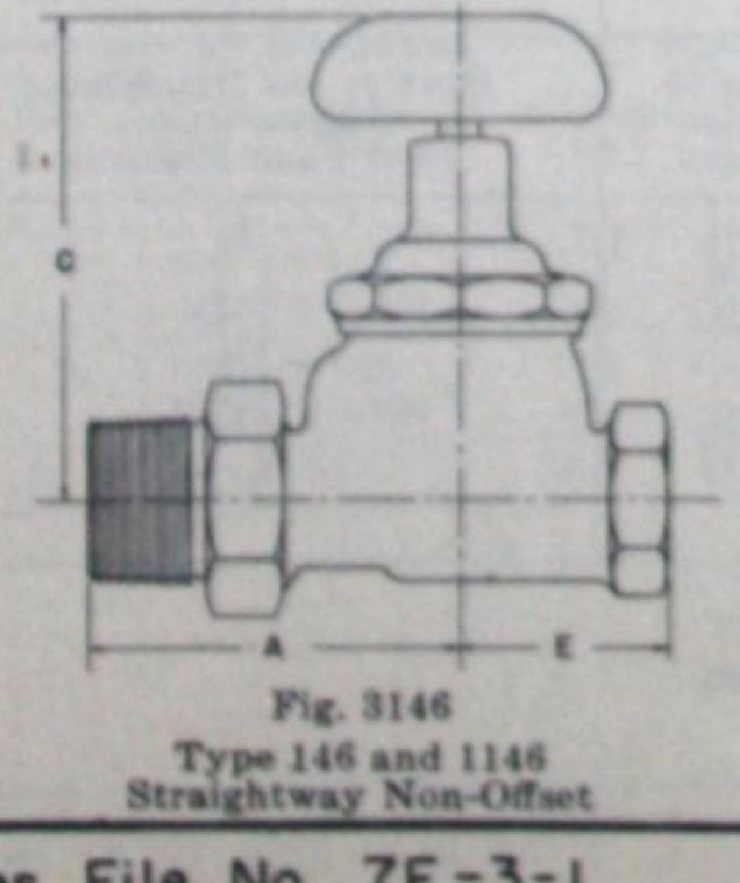
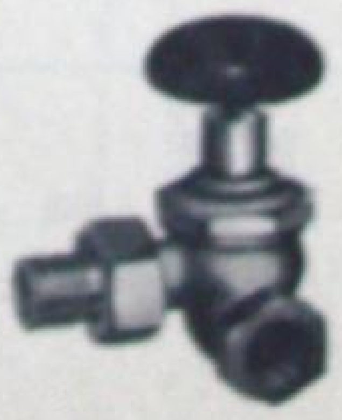


Fig. 3146
Type 146 and 1146
Straightway Non-Offset



Left Hand

PARTS

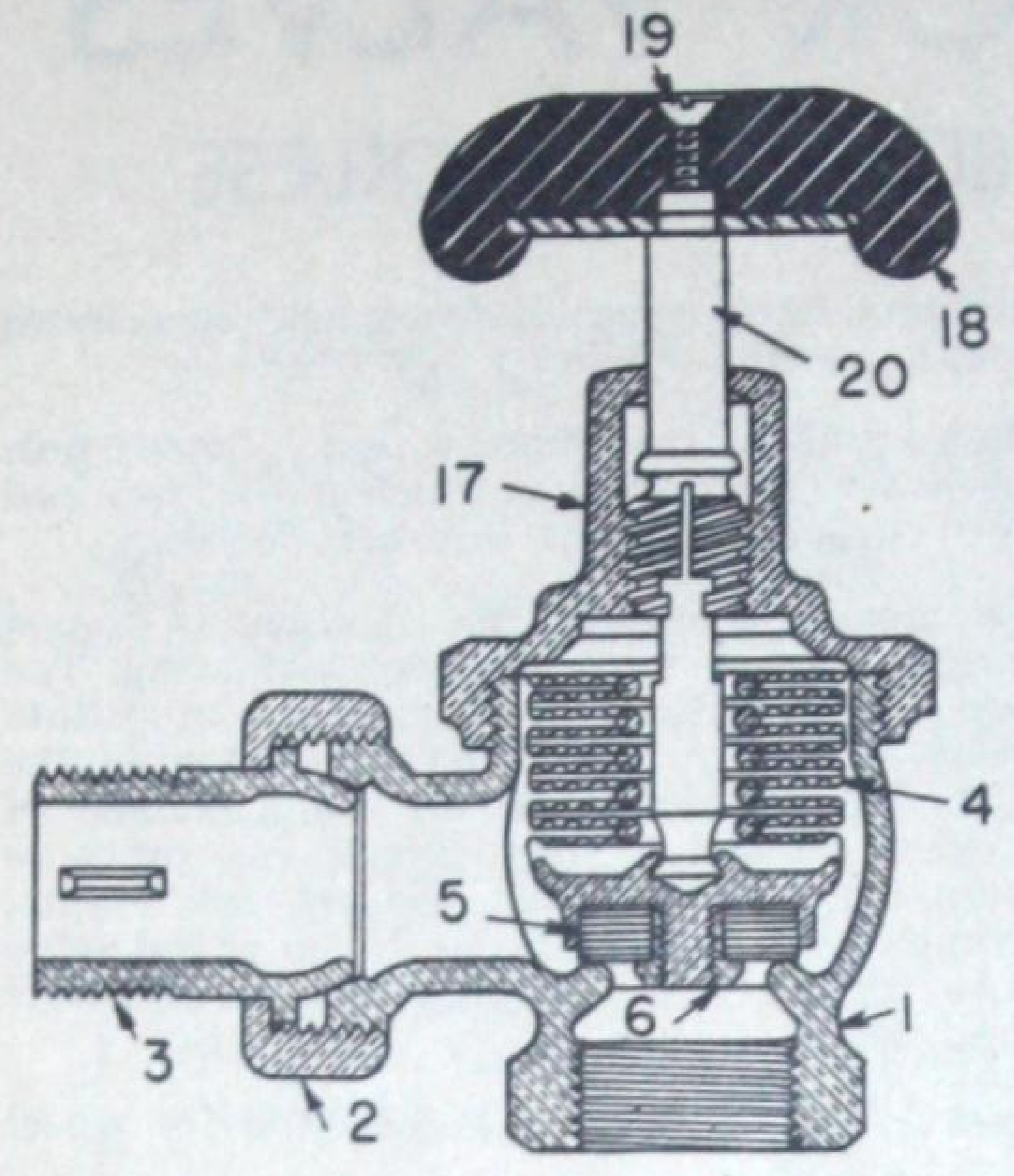


Fig. 923C
Section View and Parts
of Type 140 Valve

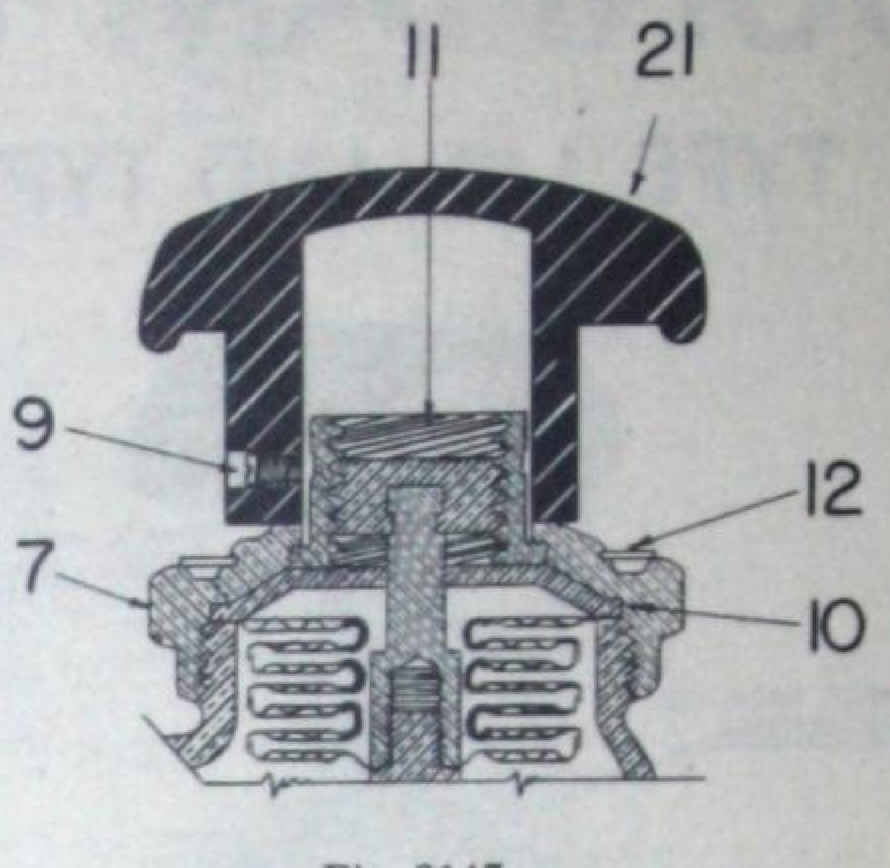


Fig. 3147
Section View and Parts of
Type 1140 Valve Bonnet and Handle Assembly

Parts on Fig. 923C for Type 140 Valve, also apply to Type 1140 Valve except as shown.

Expansion Member complete includes spindle, corrugated diaphragm, disc and disc nut.

When ordering parts give type and size of valve.

1. Body
2. Nut
3. Nipple
4. Expansion Member complete with Composition Disc
5. Composition Disc only
6. Holder Nut
7. Bonnet (1140)
9. Handle Head Screw
10. Guide Plate
11. Spindle Nut and Screw
12. Dial
17. Bonnet
18. Composition Handle (140)
19. Handle Screw
20. Handle Stem
21. Composition Handle (1140)

TYPICAL RADIATOR CONNECTIONS

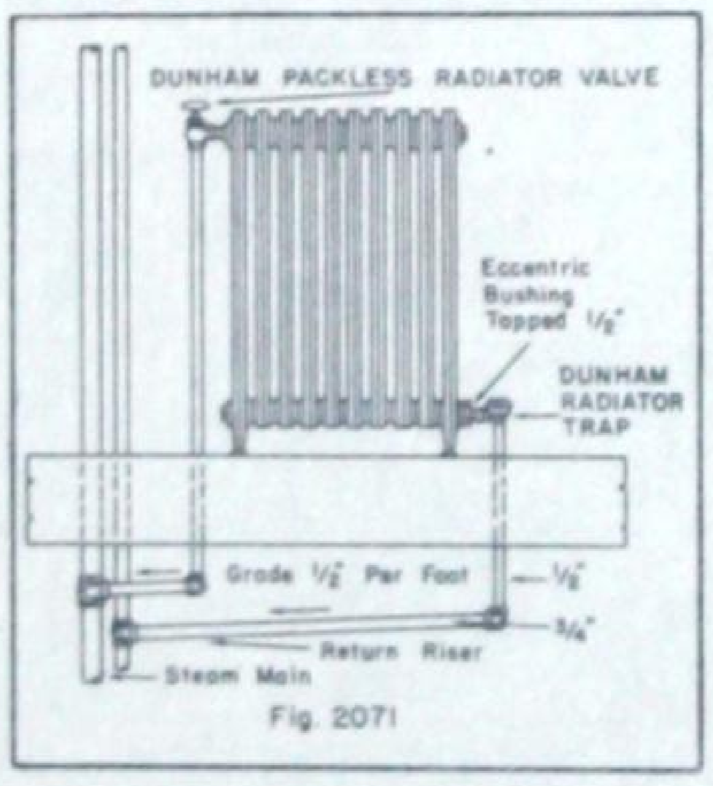


Fig. 2071

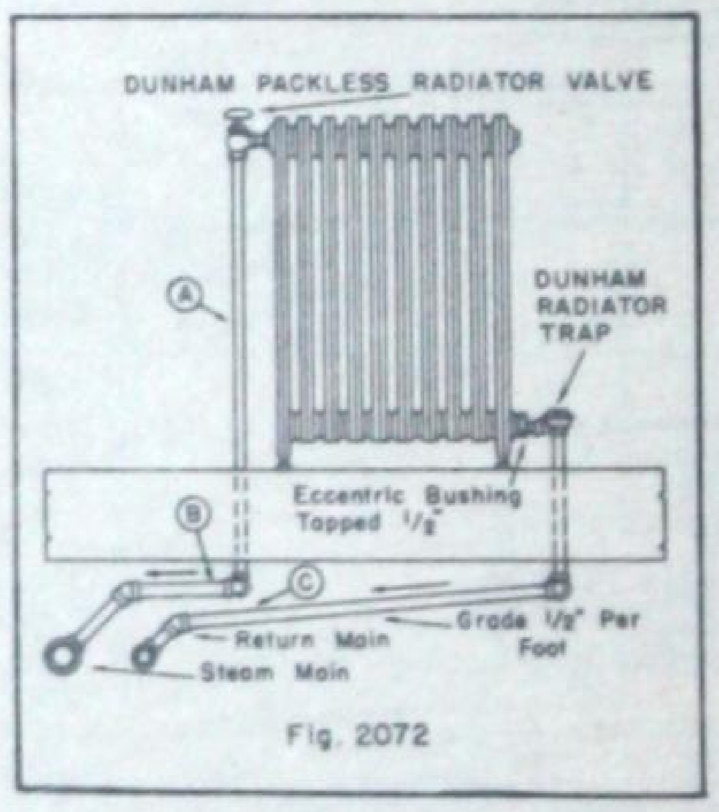


Fig. 2072

SCHEDULE OF RADIATOR VALVE SIZES AND SUPPLY CONNECTIONS

FOR SUB-ATMOSPHERIC STEAM HEATING SYSTEMS USING REGULATING PLATES

Square Feet of Direct Radiation	Supply		
	Size Inlet Valve Inches	Vertical Pipe to Inlet Valve	Horizontal Runout to Riser or Spring-piece to Main from a First Floor Radiator
1- 25	½	½	¾
26- 80	¾	¾	1
81-100	¾	¾	1¼
101-140	¾	¾	1¼
141-170	¾	¾	1½

FOR STANDARD TWO-PIPE STEAM HEATING SYSTEMS WITH RADIATOR TRAP

Sq. Feet EDR	SUPPLY CONNECTIONS—INCHES		
	Inlet Valve	Vertical Pipe to Inlet Valve	Horizontal Runout to Riser or the Springpiece to Main from a First Floor Radiator
1- 25	½	½	¾
26- 80	¾	¾	1
81-100	¾	¾	1¼
101-140	1	1	1¼
141-180	1	1	1½
181-300	1¼	1¼	1½
301-450	1½	1½	2
451-700	2	2	2½

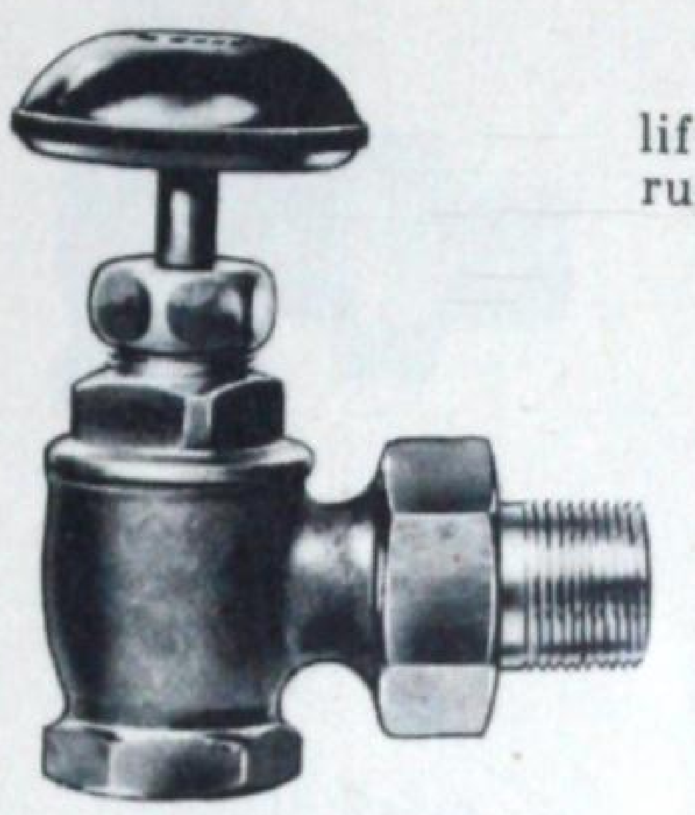
Use pipes one size larger for horizontal connections over 8′ 0″ long. Grade horizontal connections with a fall not less than ½″ per foot.

DUNHAM RADIATOR VALVES

TYPES 600 AND 646 —WHEEL HANDLE

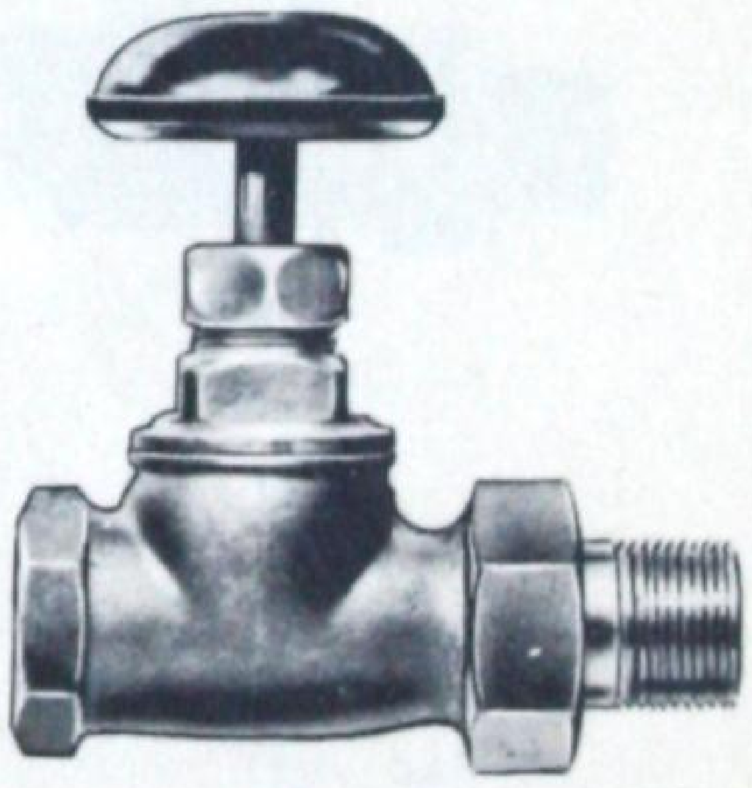
(PACKED)

This valve is designed for heating systems enerally and is particularly suitable for two-pipe team systems.



Type 600 Valve
Non-rising stem and high lift feature the design of this rugged radiator valve.

The valve is of non-rising stem design. The tem *revolves in* rather than *pulls through* the acking, reducing wear and increasing packing fe. The valve opens and closes easily without inding. A rugged packing nut and gland holds he molded packing in place. The non-breakable andle is molded of a heat-resisting composition vith a metal plate insert which prevents the andle turning on the stem. All parts are readily ccessible and interchangeable.



Type 646 Valve
A straightway, non-offset valve of Type 600 design specially adapted for convector application.

The Type 600 Valve is Angle Pattern; The ype 646 is the same basic valve in a Straightway Non-Offset Pattern specially developed for convector application.

Valves have rough-finished brass bodies. Specify Catalogue Number or Type Number and size on order.

Lock and shield equipment can be furnished with any size of Type 600 and 646 Valves at no extra cost. Keys are supplied as extras.

DIMENSIONS

Size Ins.	Type No.	Cat. No.	Net Weight Lbs.	Dimensions in Inches			
				A	B	C	E
½	600	P½A	1¼	2½	1$\frac{1}{16}$	3⅛	—
	646	P½SN	1¼	2¾	—	3½	1½
¾	600	P¾A	1½	2¾	1¼	3⅝	—
	646	P¾SN	1¾	2¾	—	3⅝	1½
1	600	P1A	2	2⅞	1$\frac{7}{16}$	3¾	—

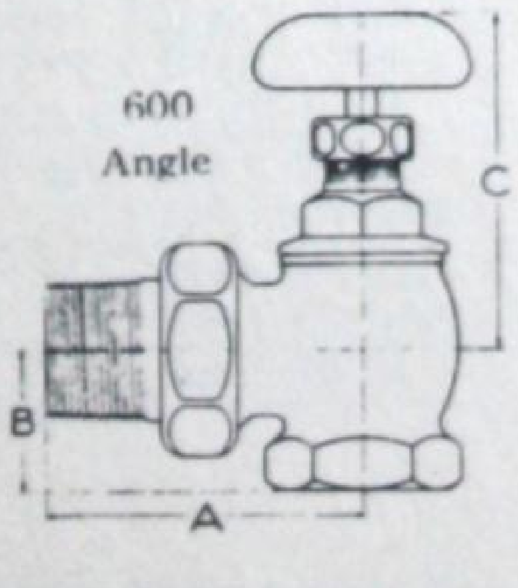


Fig. 1169

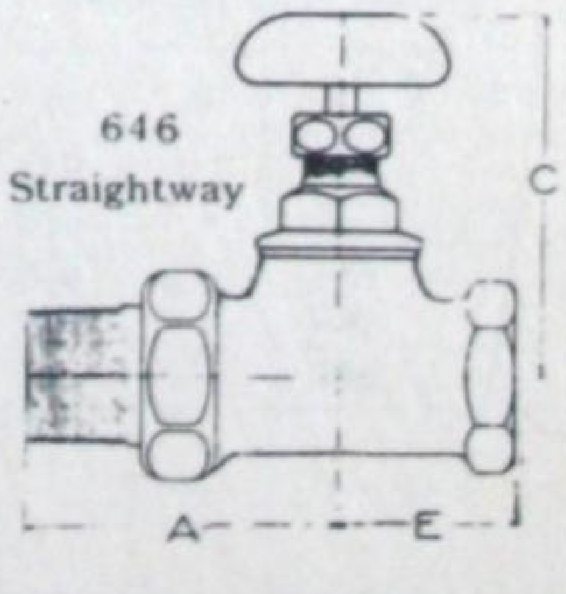


Fig. 3091

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APT INTERNATIONAL

CCA

DUNHAM RADIATOR VALVES

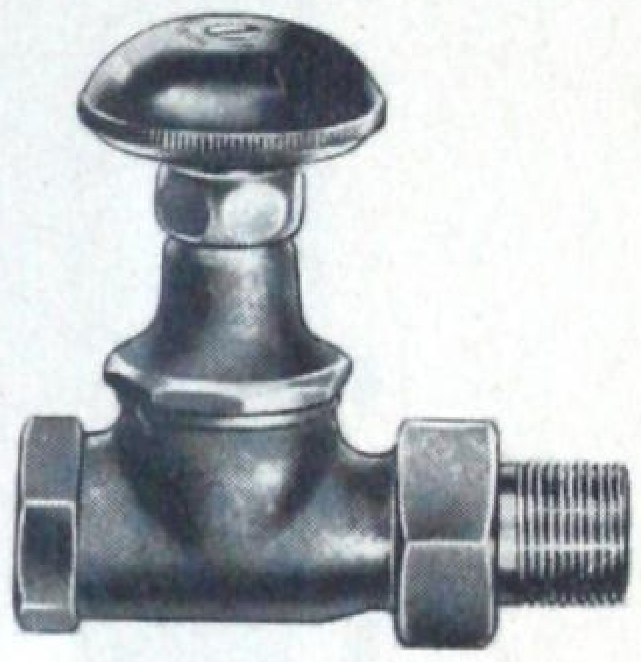
TYPES 200 AND 246 — WHEEL HANDLE

(COMMERCIAL PACKLESS)

These Radiator Valves are designed for low essure steam heating service. A heavy bronze il spring keeps a constant pressure on a special aphited asbestos composition ring formed under essure to exact size and shape to maintain a ht seal around valve stem. The construction described by the trade as "packless".

An advantageous feature of this design is that e non-rising stem *revolves in* rather than *pulls rough* the packing, thus causing minimum wear d giving long packing life. They are made in ngle and Straightway Patterns.

Type 200 Valve



Type 246 Valve
A straightway, non-offset valve of Type 200 design specially adapted for convector application.

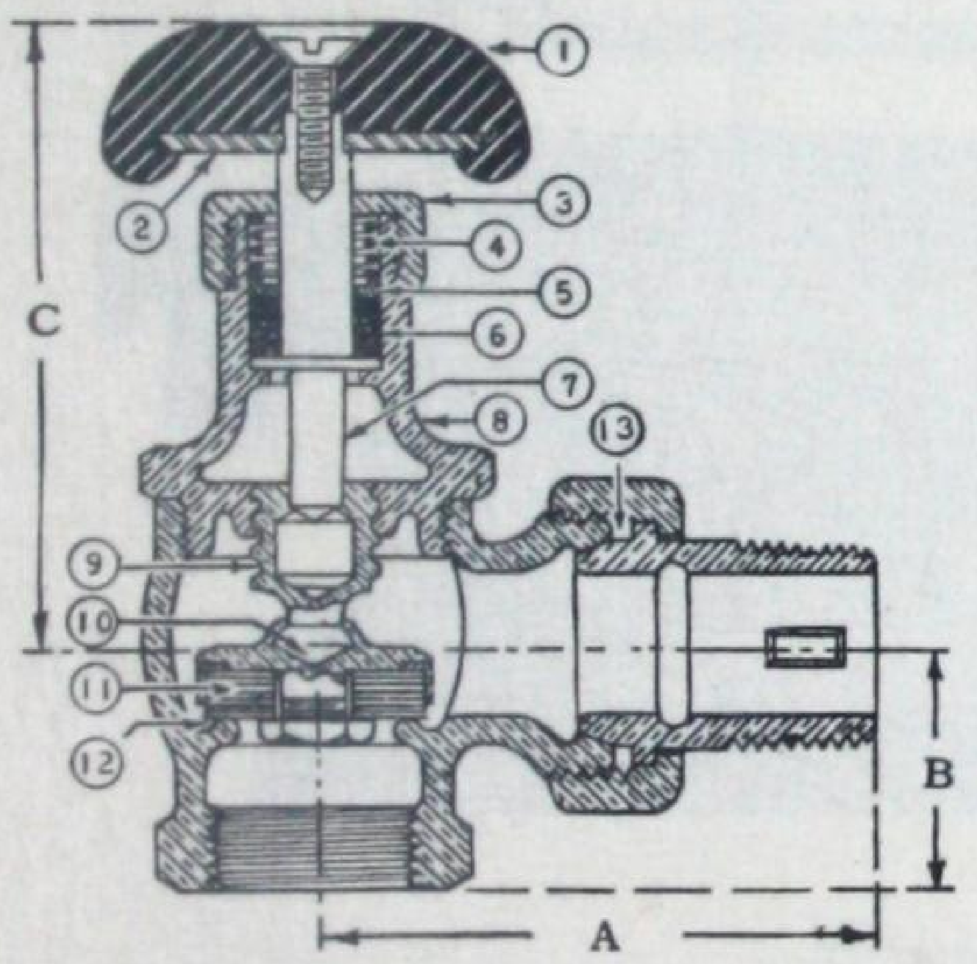
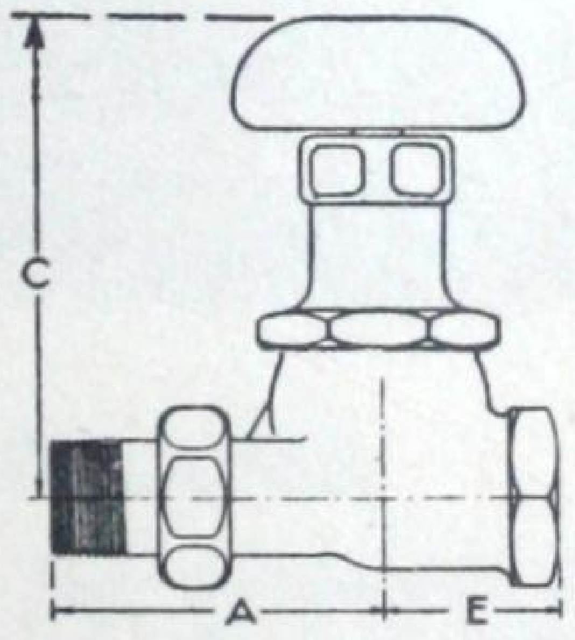


Fig. 1671
Section view of Type 200 Valve showing details of construction.



Type 246

CONSTRUCTION FEATURES

Special heat-resisting non-breakable composition handle ves good grip.
Metal re-inforcement integral part of handle.
Compression spring nut.
Heavy bronze coil spring keeps constant pressure on ecial composition packing ring.
Gland.
Heat-resisting graphited asbestos ring with metal core. ormed to exact shape and size. Held under compression by avy coil spring to maintain tight seal around valve stem.
Non-rising handle stem.
Low valve bonnet.
Large diameter screw provides easy smooth operation.
Ball joint insures perfect seating preventing steam akage when valve is closed.
. High quality renewable composition disc.
. Rounded valve seat provides tight seating.
. Long tapered joint of union permits easy make-up.

DIMENSIONS

Size Ins.	Type No.	Cat. No.	Net Weight Lbs.	Dimensions in Inches			
				A	B	C	E
½	200	SW½A	1¼	2½	1¹⁄₁₆	3¼	—
	246	SW½SN	1¼	2⅝	—	3½	1½
¾	200	SW¾A	1½	2¾	1¼	3⅜	—
	246	SW¾SN	1¾	2⅝	—	3¾	1½
1	200	SW1A	2	2⅞	1⁷⁄₁₆	3¾	—

Valves have rough-finished brass bodies. Specify Catalogue Number or Type Number and Size on Order.

Lock and shield equipment can be furnished with any size of Type 200 and 246 Valves at no extra cost Keys are supplied as extras.

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RETU

A vacuum re
pipe system (u
points) in which
rapidly and yet
operation of a v
partial vacuum

The Ty
centrifugal
Separating
gauge, an
trol Equip
iron base
suction st
included.
float switch
part of th
application
most adv
The P
of non-c
smooth s
The I
rigid to
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Replaces F
Dated: D

The

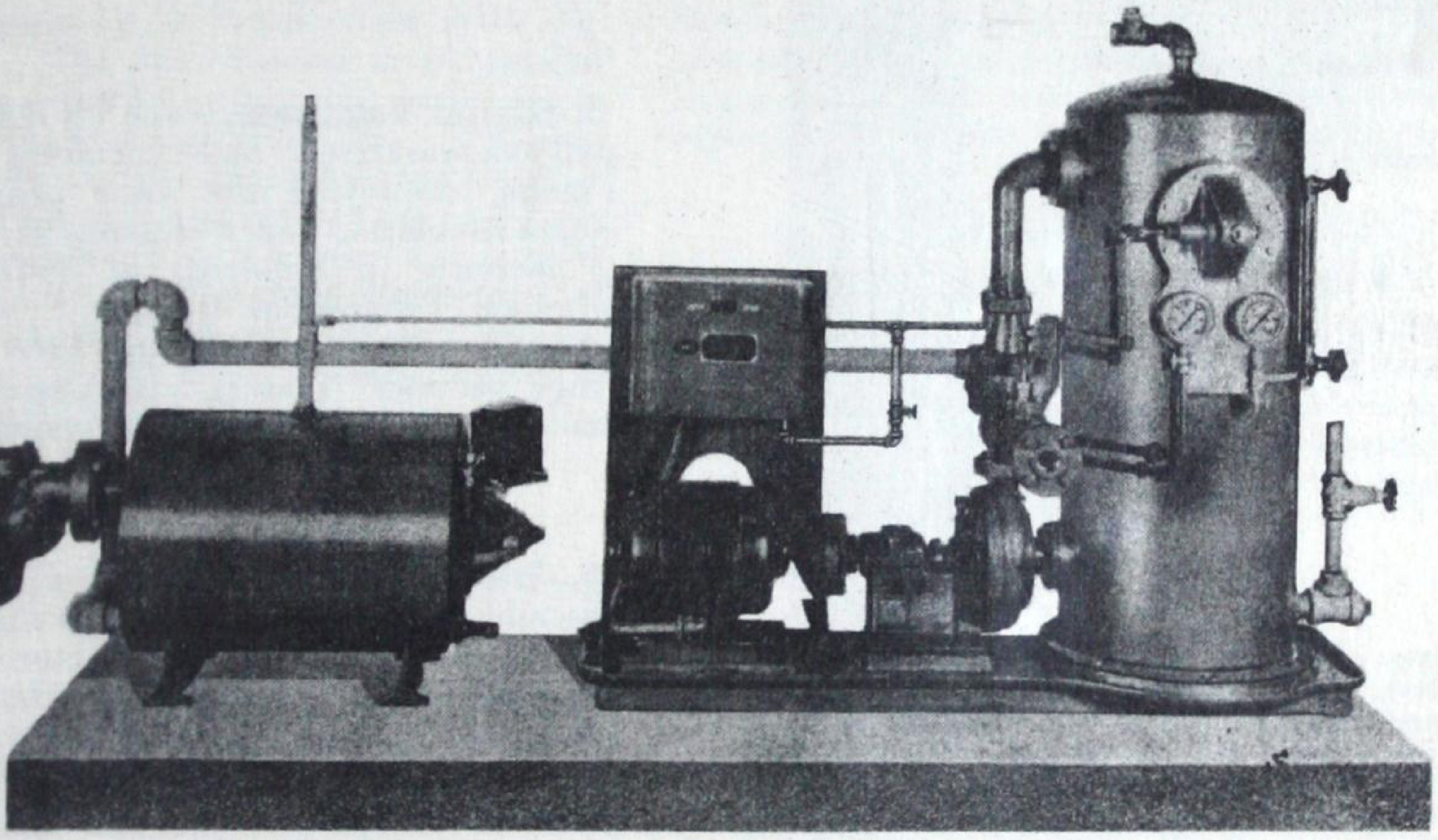
DUNHAM VACUUM RETURN LINE HEATING PUMP

TYPE VR

A vacuum return line heating system is a two-e system (using traps at radiators and drip ints) in which steam is circulated positively and idly and yet at low pressures as a result of the eration of a vacuum pump. The pump maintains partial vacuum on the return lines by exhausting air from the system. It also returns condensate to the boiler or boiler feed apparatus.

Type VR Pumps are designed specially to perform these two major functions:

(1) To create and maintain a vacuum in the return piping of the heating system; (2) To return all condensate to boilers or boiler feed apparatus.



CONSTRUCTION FEATURES

The Type VR Pump comprises a motor, entrifugal pump, an Exhauster Assembly, an Air eparating Tank with vacuum, pressure and water auge, an Automatic Discharge Valve and a Con- rol Equipment Panel all assembled on a rigid cast on base to make a complete, compact unit. A uction strainer, check valves and air vent are ncluded. An Accumulator Tank with float head, loat switch and mounting saddles is also a standard art of the Pump unit on all automatic control pplications. It is mounted separately to permit ost advantageous installation arrangement.

The Pump is bronze fitted and the shaft is f non-corrosive steel with a hard, glazed, mooth surface.

The Base, of cast iron, is well braced and igid to maintain pump and motor in proper lignment.

The Automatic Discharge Valve is single seated, float operated and fully automatic.

The Control Equipment Panel, as neat as a piece of metal furniture, completely assembled at the factory, simplifies both installation and operation.

Couplings between motor and pump shaft are of the reliable flexible disc type.

Vacuum and Pressure Gauges continuously indicate the vacuum in the system and the pressure of the pump discharge to boiler.

Motors are of 40 degree rating of best standard manufacture with ample margin of power.

Motor speeds in excess of 1800 RPM are not used.

COMFORT CONDITIONING by DUNHAM

PRINCIPLE AND PERFORMANCE

Streams of water at high velocity possess energy which can be made to do useful work. The Dunham Type VR Pump applies this fact to the special problem of withdrawing air, water and condensable gases from vacuum return line heating systems and returning the water, freed from air, to boilers.

The Dunham Exhauster employs flaring jets of water to entrain condensate, to envelop air and to condense water vapor drawn into it from the heating system.

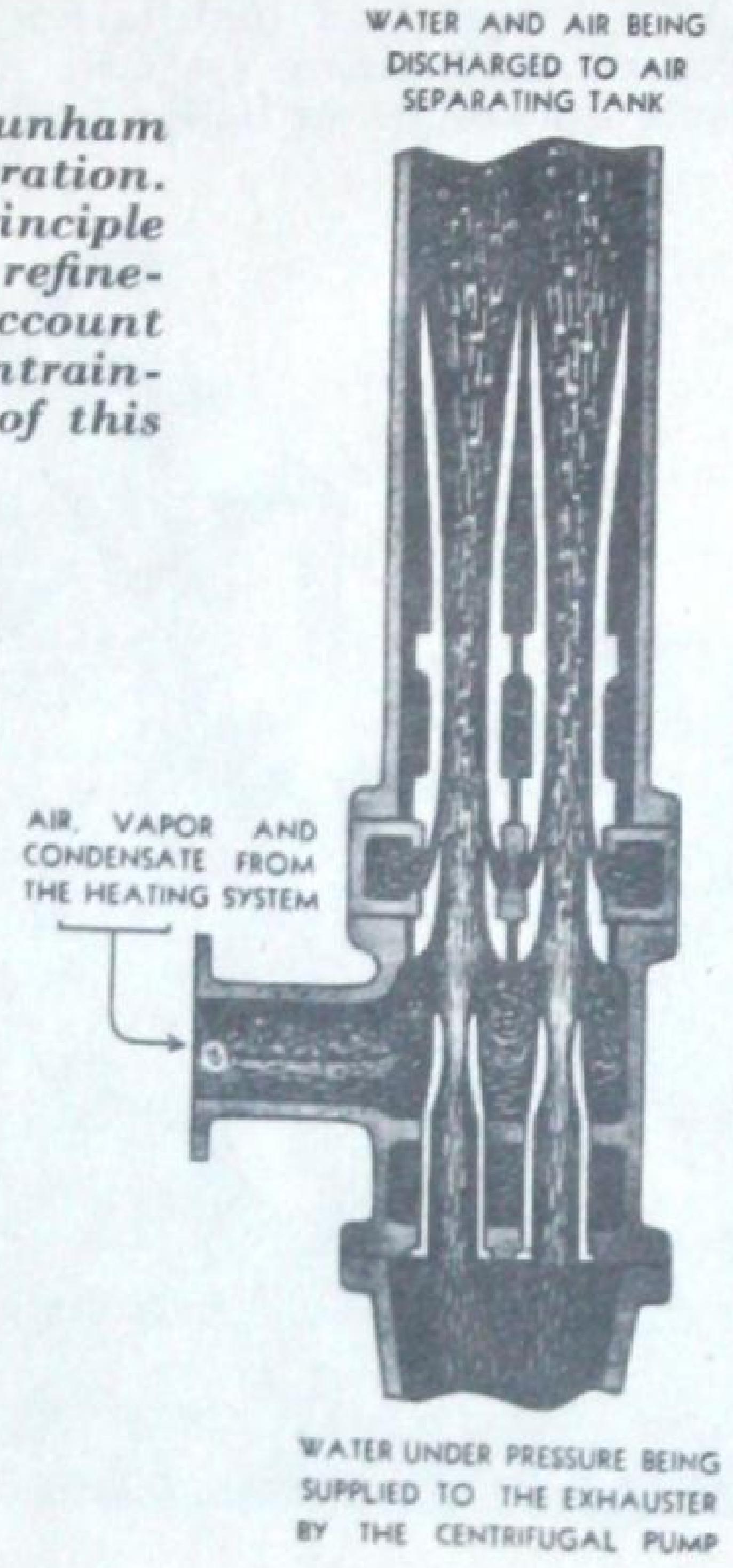

WATER AND AIR BEING DISCHARGED TO AIR SEPARATING TANK
AIR, VAPOR AND CONDENSATE FROM THE HEATING SYSTEM
WATER UNDER PRESSURE BEING SUPPLIED TO THE EXHAUSTER BY THE CENTRIFUGAL PUMP

Fig. 2038—*The Dunham Exhauster in operation. Simplicity in principle and scientific refinement in design account for the high entrainment efficiency of this assembly.*

1. Simple. In principle the pump is as simple as an insect spray gun. A single impeller provides energy both for suction on the system and for discharge of condensate to boilers.

. . .

2. Adaptable. The Type VR Pump is adaptable to the varying engineering requirements of all types of installation. It may be installed in single or duplex arrangements with manual control or various combinations of automatic control, without or with Accumulator Tank which, when used, may be installed in a pit or at the pump level or distant from the pump. The use of the Accumulator Tank permits a most economical arrangement of controls, ready alterations in boiler room plans and better layout where floor space is cramped

3. Efficient. Air handling capacity increases as the return of condensate decreases with maximum efficiency under average heating system operating conditions. Power consumption decreases as the rate of condensate return decreases. The Exhauster acts as a water jet condenser thus increasing the exhausting efficiency of the pump by handling the vapor load which under certain conditions exceeds either the air or the condensate load.

. . .

4. Economical. Overall operating costs are low because Type VR Pumps are easy on power and operate with minimum supervision and low maintenance expense over an exceptionally long life.

. . .

5. Higher Vacuums. Type VR Pumps consistently pull comparatively high vacuums. Dunham DV Pumps, employing the same principle, maintain steam circulation under vacuums as high as 25 inches of mercury in hundreds of installations of the Dunham Differential Heating System. Dunham research and unrivalled experience in this field of "high vacuum" heating have been drawn upon to make VR Pumps efficient and economical.

. . .

6. Easy to Install. The compact, pretested assembly of pump and controls makes installation simple for the heating contractor and electrician. Internal wiring is completed at the factory. The electrician has only to connect the power lines and lines from the Accumulator Tank to the terminals of the pump control panel.

. . .

7. Easy to Operate. Type VR Pumps normally require no other attention than oiling. Pressure and vacuum gauges indicate performance at a glance. Extra care in manufacture decreases care in service.

. . .

8. Reliable. The fact that there are no moving parts and no definite clearances to be maintained in the Exhauster practically eliminates wear and reduction in efficiency through use. This design does away with adjustments such as needed to compensate for wear of moving parts of the vacuum producing apparatus of displacement type pumps. Simple design, rugged construction, careful assembly and thorough testing before shipment are reasons for the reliable performance of Type VR Pumps.

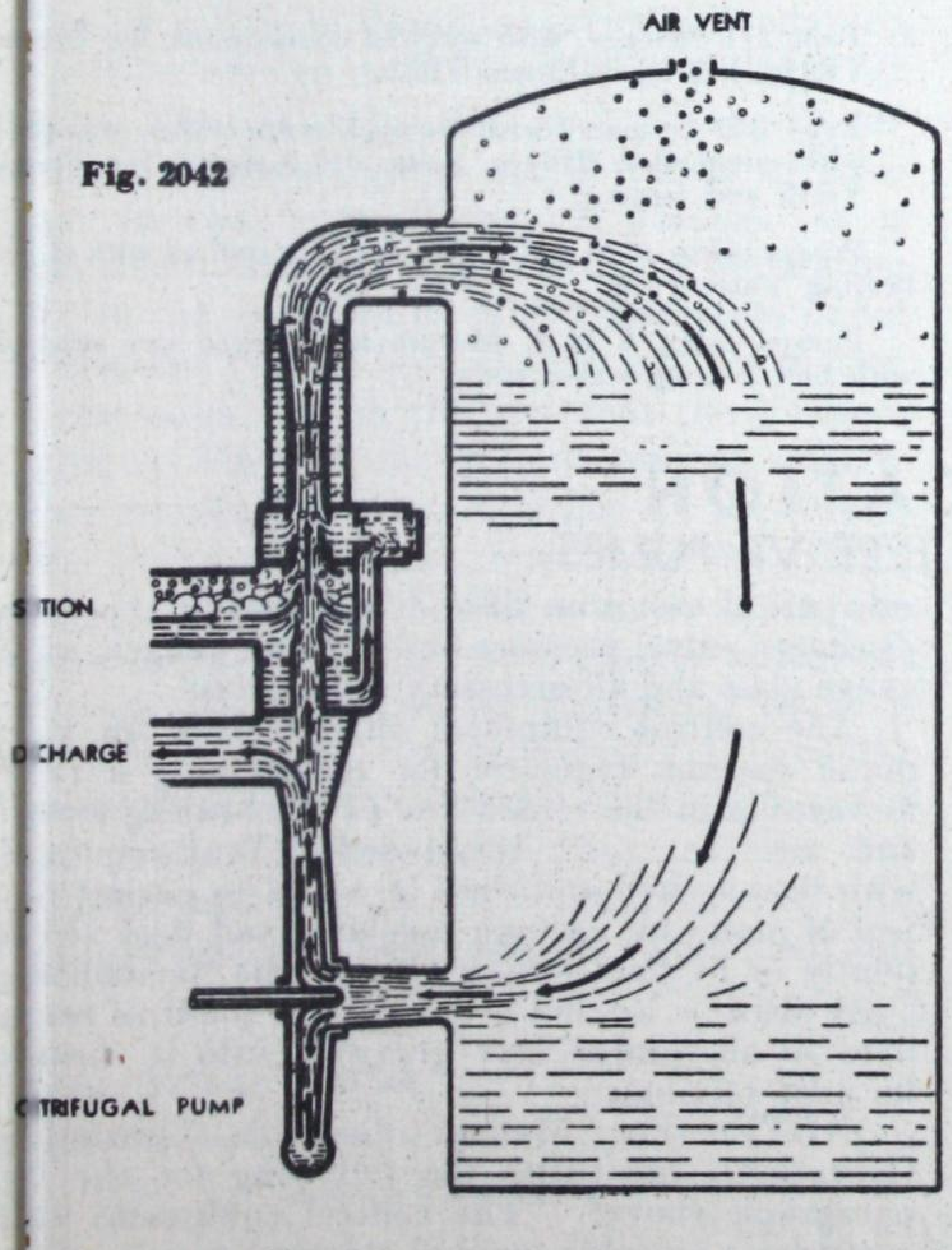
CONTROL APPLICATIONS

The construction, layout and purpose of a build-i as well as the design of the heating system i uence the type of control to be selected for the p mp. Type VR Pump control arrangements are sufficiently flexible to meet every type of requirement encountered in vacuum return line heating service. The following applications are by far the most commonly required.

(1) SINGLE AUTOMATIC INSTALLATION (Figure 3)

This arrangement maintains a vacuum between ed maximum and minimum limits in the return es of the heating system. It also returns con- nsate to boilers whether or not the vacuum control i in operation. It is applicable whether return ains come back above, at, or below the boiler water e or the pump suction. The Accumulator Tank is stalled at a level which will permit condensate to avitate into it and is equipped with a float switch ntrol which operates in conjunction with the cuum control. The float control is in parallel th the vacuum control so that the pump starts enever the Accumulator Tank fills with con- nsate irrespective of the demand of the vacuum ntrol. A manual switch provides means to cut out e vacuum control whenever it is desired to operate e pump solely on float control for return of ndensate during night-time or week-end periods. his arrangement gives greatest economy in current nsumption during night operation.

Fig. 2042



(2) DUPLEX AUTOMATIC INSTALLATION (Figure 6)

This arrangement is essentially similar to the Single Automatic Installation except that two pumps are used with a single Accumulator Tank. Controls are arranged so that either pump may be operated separately or both simultaneously under the same combination of vacuum control with parallel float control from the Accumulator Tank to ensure condensate return under all operating conditions. The Duplex Installation minimizes the likelihood of a shut-down when emergency conditions arise and additionally affords maximum economy on larger systems by permitting a variation in pump capacity in relation to heating demand.

(3) CONTINUOUS OPERATION INSTALLATION (Figure 4)

On installations where the piping system contains lifts some distance from the pump, automatic control would result at times in the holding up of condensate in the system. For such installations, a control which will keep the pump in continuous operation may be desirable.

Fig. 2042—*Illustrating the simple operating cycle of the Dunham Pump. Water, energized by the centrifugal pump and delivered to the Exhauster, becomes a carrier which picks up a cargo of air and condensate, transports this cargo into the Air Separating Tank, there unloads the air by venting to atmosphere and carries the condensate on through the pump, discharges it under pressure and repeats the cycle of flow through the Exhauster.*

ORDERING

Orders should give the following information:

1. Type of Application { Single Automatic / Duplex Automatic / Continuous Operation }
2. Catalog No.
3. Capacity in Sq. Ft. EDR
4. Discharge Pressure
5. Electrical Characteristics complete
   (a) Phase
   (b) Cycle
   (c) Volts—(one voltage)
6. Shipping Instructions
7. Any special billing instructions

ENGINEERING DATA

Dunham Vacuum Return Line Heating Pumps are tested and rated in accordance with the A.S.H. & V.E. Code and the Code of the Vacuum Return Line Heating Pump Manufacturers Section of the Hydraulic Institute. Capacities are based on standard tests made at 5½ inches of vacuum (being the average of 3" and 8" of vacuum, common limits for vacuum return line heating), with water, saturated air and vapor at a temperature of 160° F. and with a discharge pressure of 20 pounds.

CAPACITIES OF TYPE VR PUMPS

Pump Cat. No.	RATED CAPACITIES				Motor H.P. for Discharge Pressure of			Accum. Tank Size Inches	Shipping Weight Lbs. Approximately		
	Sq. Ft. EDR	Water only G.P.M. (U.S.)	Simultaneous						Pump Only		*Acc. Tank
			Water G.P.M.	Air C.F.M.	15 lbs.	20 Lbs.	30 Lbs.		15 & 20 Lbs.	30 Lbs.	
VR1¼	**1250**	1.9	.63	.63	½	—	—	16x16	280	—	170
VR2½	**2500**	3.8	1.3	1.3	—	¾	2	16x16	750	800	170
VR5	**5000**	7.5	2.5	2.5	—	¾	2	16x16	875	925	170
VR10	**10000**	15.0	5.0	4.0	—	1½	3	16x16	950	1000	170
VR15	**15000**	22.5	7.5	5.4	—	1½	3	16x24	975	1025	185
VR20	**20000**	30.0	10.0	6.8	—	2	5	16x24	1000	1090	185
VR25	**25000**	37.5	12.5	8.3	—	3	5	16x24	1125	1185	185
VR30	**30000**	45.0	15.0	9.7	—	3	7½	16x36	1170	1350	230
VR40	**40000**	60.0	20.0	12.6	—	5	7½	16x36	1225	1345	230
VR65	**65000**	97.5	32.5	19.8	—	5	7½	24x36	1365	1485	300

**Accumulator Tanks are included with all Pumps ordered for automatic control applications.*

• • •

40 lb. Discharge Pressure Pump are supplied only in 60 cycle current. Data on request.

• • •

Pumps of 100,000 and 150,000 square feet EDR capacity are available on order. Data on request.

• • •

Pumps with 20 pound Discharge Pressure are standard and will be supplied unless otherwise specified.

• • •

Care should be taken to select a pump with a discharge pressure great enough to more than equal the boiler pressure plus difference in elevation plus pipe friction.

• • •

Each pump is given a thorough operating test of several hours' duration under its own control and power before shipment.

• • •

MATERIAL FURNISHED WITH PUMP:

1. Swing Check Valves for (a) pump suction, (b) discharge, and (c) air vent.
2. Dunham Air Check for vent from Accumulator Tank of automatic control pumps.
3. Type 211 Strainer, with screwed connections, for Pumps VR1¼, VR2½, VR5 and VR10.

Type 210 Strainer, with flanged connections, complete with companion flanges, bolts and gaskets, for Pumps VR15 and larger.

• • •

Pumps using up to 5 H.P. Motors are supplied with sleeve bearing water ends.

• • •

Pumps using 5 H.P. Motors and larger are supplied with ball bearing water ends.

• • •

SPECIFICATION

SUGGESTED FOR TYPE VR PUMPS

Furnish and install, as directed by plans and manufacturer's instructions, one (or Duplex) Dunham Vacuum Return Line Heating Pump (s), size .... (each) having a rating of .... sq. ft. of equivalent direct radiation rated upon the basis of the A.S.H. & V.E. Vacuum Heating Pump Code and capable of operating against a 20 pound discharge pressure at the pump. (Each) Pump shall be driven by a direct connected, ... H.P. motor, of 40° Centigrade rating, operating at a speed not in excess of (1,750 R.P.M. for 60 Cycle) (1,425 R.P.M. for 25 or 50 Cycle) and wound for .... Volts, ... Phase, ... Cycles.

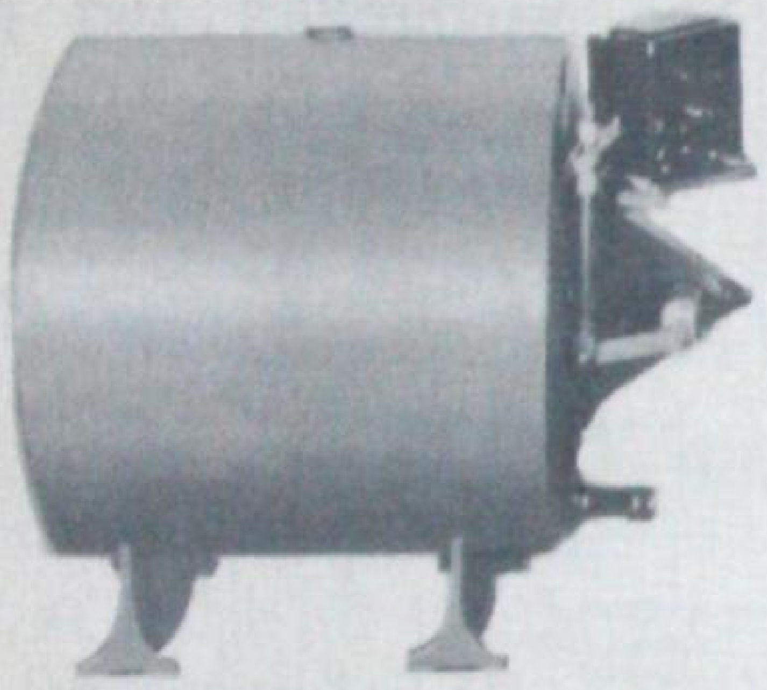
The Pump(s) shall consist of bronze fitted, enclosed impeller centrifugal pump with non-corrosive metal shaft, exhauster, welded steel tank, electric controls panel and motor all mounted on substantial cast iron base of the coping type with discharge valve, pressure and vacuum gauges, water gauge glass and all necessary accessories.

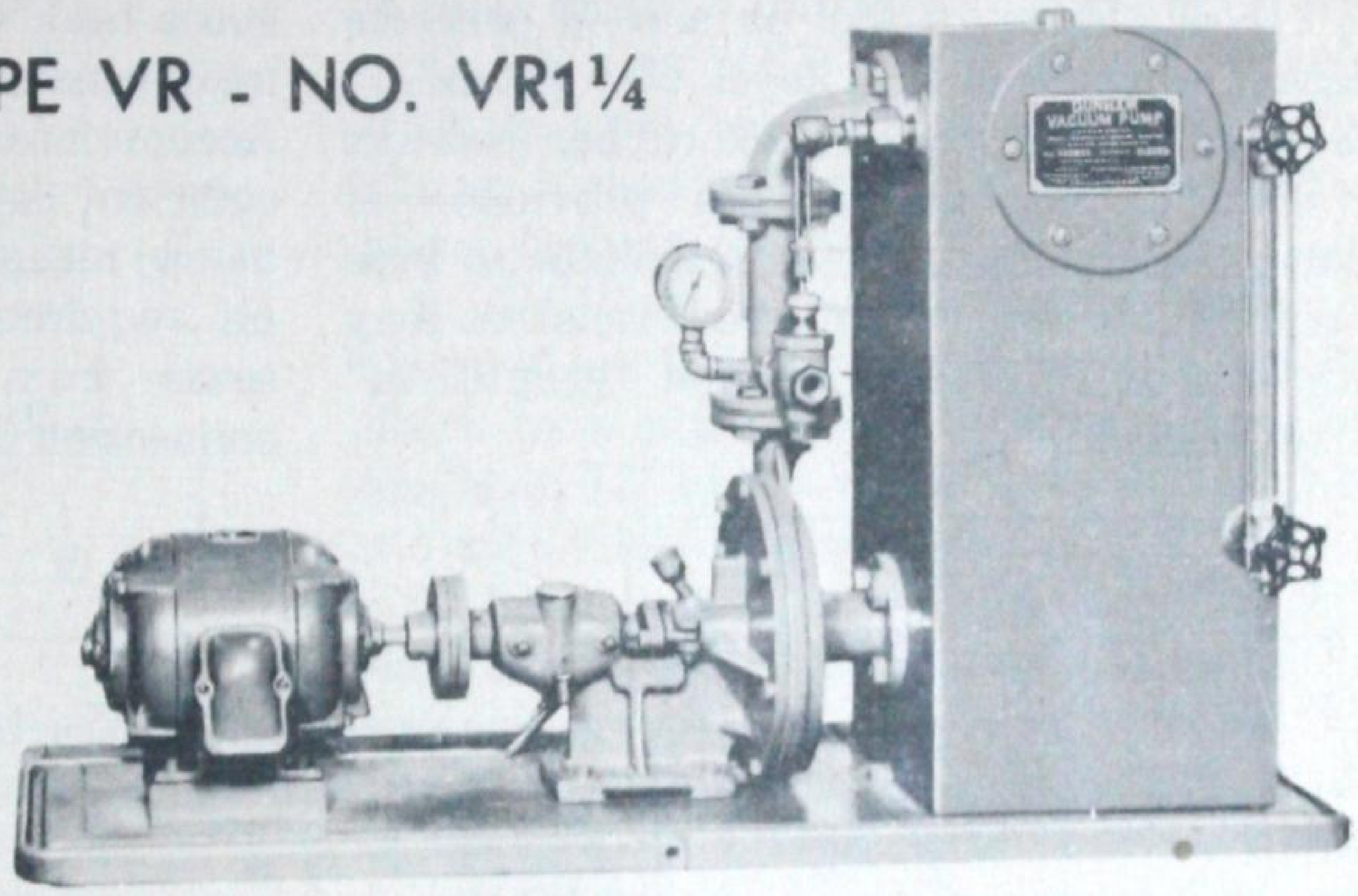
The control equipment shall include an automatic vacuum regulator for maintaining a range in vacuum in the return line of the heating system and an .... Accumulator Tank equipped with float switch and shall be wired to permit control of pump by vacuum regulator and float switch jointly or by float switch alone. The Accumulator Tank shall be located below the low point of return lines so all returns may gravitate into it through its inlet tapping.

NOTE:—For Manual Control (Continuous Operation), substitute the following for the last paragraph above: "The control equipment shall comprise a suitable manual starter."

DUNHAM VACUUM RETURN LINE HEATING PUMP

TYPE VR - NO. VR1¼





he Type VR1¼ Pump is particularly adapted fo marine service and for small buildings. It en loys the 'jet exhauster' principle as do all D nham Vacuum Pumps and is similar in basic de gn to the larger Type VR Pumps. It is di inctive in the use of a square Air Separating T k, in the provision of rubber insulators under th base and rubber hose connections for suction an discharge, and in the fact that the Vacuum R ulator, Vacuum Gauge and electric starters (w ere required) are not mounted on the Pump.

he Pump comprises a motor and centrifugal p np connected by flexible disc coupling, jet ex auster assembly, pressure gauge, automatic di harge valve, and an air separating tank all as embled on a rigid cast iron base. A Type 211 S tion Strainer with screwed connections, and s ng check valves for (a) pump suction, (b) di harge, and (c) air vent are provided. An A umulator Tank, as shown, with float head and switch and mounting saddles is also standard on all automatic control units. A Dunham Air Check is provided for vent from the Tank. Special low cradles with lugs for bolting down Accumulator Tank are available for marine service.

The Pump is bronze fitted and the shaft is of non-corrosive steel with a hard glazed, smooth surface.

The Base, of cast iron, is well braced and rigid to maintain pump and motor in proper alignment.

The Automatic Discharge Valve is single seated, float operated and fully automatic.

Motors are of 40 degree rating of best standard manufacture with ample margin of power.

Motor speeds in excess of 1800 RPM are not used.

Various arrangements of control adapt this Pump to all vacuum return line heating requirements encountered in marine or land service.

PHYSICAL DATA

C acity: **1250 sq. ft. EDR**

D charge Pressure: **15 lbs.**

M or H.P.: **½** **Accum. Tank Size:** **16″ x 16″**

hip. Weight Approx:

P np Only: **280 lbs.** **Accum. Tank:** **170 lbs.**

Standard Water and Air Capacities:

Water Only (at 160° F. and 5.5″ vacuum to 15 lbs.)
: **1.9 GPM (US)**

Simultaneous {
Air (at 160° F. and 5.5″ vacuum)
: **.63 CFM**
Water (as above)
: **.63 GPM**

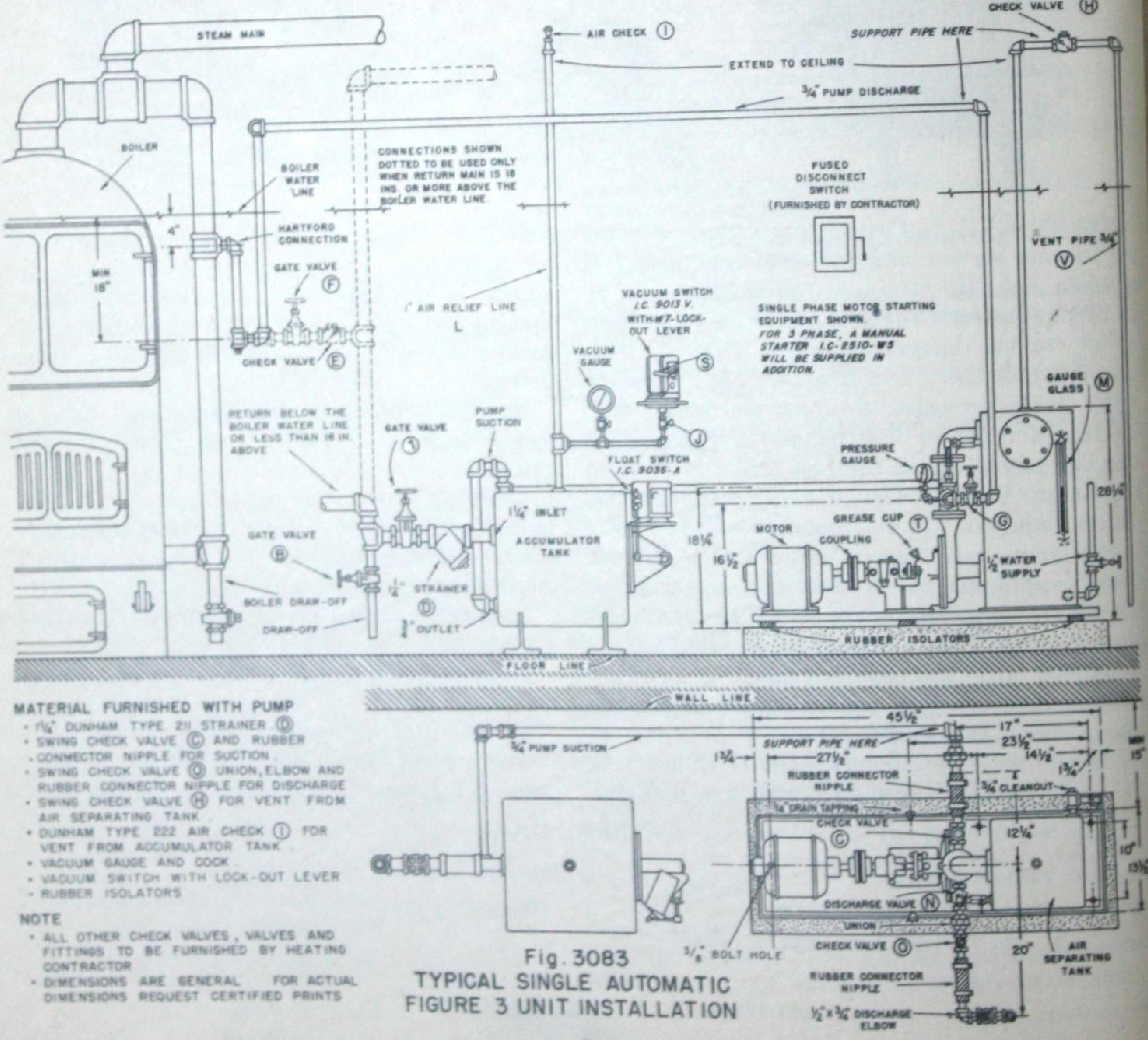
INSTALLATION INSTRUCTIONS

READ THESE INSTRUCTIONS CAREFULLY BEFORE PROCEEDING

UNCRATING: When uncrating PUMP, leave all instructions and tags attached to PUMP, and temporary plugs in PUMP tappings until installed on foundation and ready to connect to piping.

SETTING: Place PUMP on a solid concrete foundation, with a smooth level top, extending from 3″ to 6″ above floor. Place rubber isolators under PUMP base in recesses provided. If necessary, place shim under each isolator so base bears equally on each. If desired, isolators may be omitted and PUMP bolted and "grouted-in" direct to foundation.

ACCUMULATOR TANK: Locate the Accumulator Tank as high as possible but with outlet not higher than 6″ below PUMP suction, and at an elevation where condensate from all returns can flow into it by gravity. Provide goose neck connection on suction. If the return main runs near or under the boiler room level, the Accumulator Tank must be placed in a pit of sufficient depth to bring the inlet tapping slightly below return main. (See Fig 3085 for size of pit required). If possible, provide a drain to sewer from pit. See roughing-in and piping connection details.



MATERIAL FURNISHED WITH PUMP

- 1¼" DUNHAM TYPE 211 STRAINER Ⓓ
- SWING CHECK VALVE Ⓒ AND RUBBER CONNECTOR NIPPLE FOR SUCTION.
- SWING CHECK VALVE Ⓞ UNION, ELBOW AND RUBBER CONNECTOR NIPPLE FOR DISCHARGE
- SWING CHECK VALVE Ⓗ FOR VENT FROM AIR SEPARATING TANK
- DUNHAM TYPE 222 AIR CHECK Ⓘ FOR VENT FROM ACCUMULATOR TANK.
- VACUUM GAUGE AND COCK.
- VACUUM SWITCH WITH LOCK-OUT LEVER
- RUBBER ISOLATORS

NOTE

- ALL OTHER CHECK VALVES, VALVES AND FITTINGS TO BE FURNISHED BY HEATING CONTRACTOR
- DIMENSIONS ARE GENERAL FOR ACTUAL DIMENSIONS REQUEST CERTIFIED PRINTS

Fig. 3083
TYPICAL SINGLE AUTOMATIC
FIGURE 3 UNIT INSTALLATION

PIPING: Make pipe connections full size of t pings into which they connect, and sub- s ntially as shown by Piping Connections Details.

LIFT CONNECTIONS: No lift connections a permissible anywhere in the piping except b ween the SUCTION of the PUMP and the b tom connection of the Accumulator Tank, w en required. If this lift is greater than 4 feet, i tall the necessary lift fittings as shown by F . 3084, breaking the lift into equal parts, n ne of which should be over 4 feet.

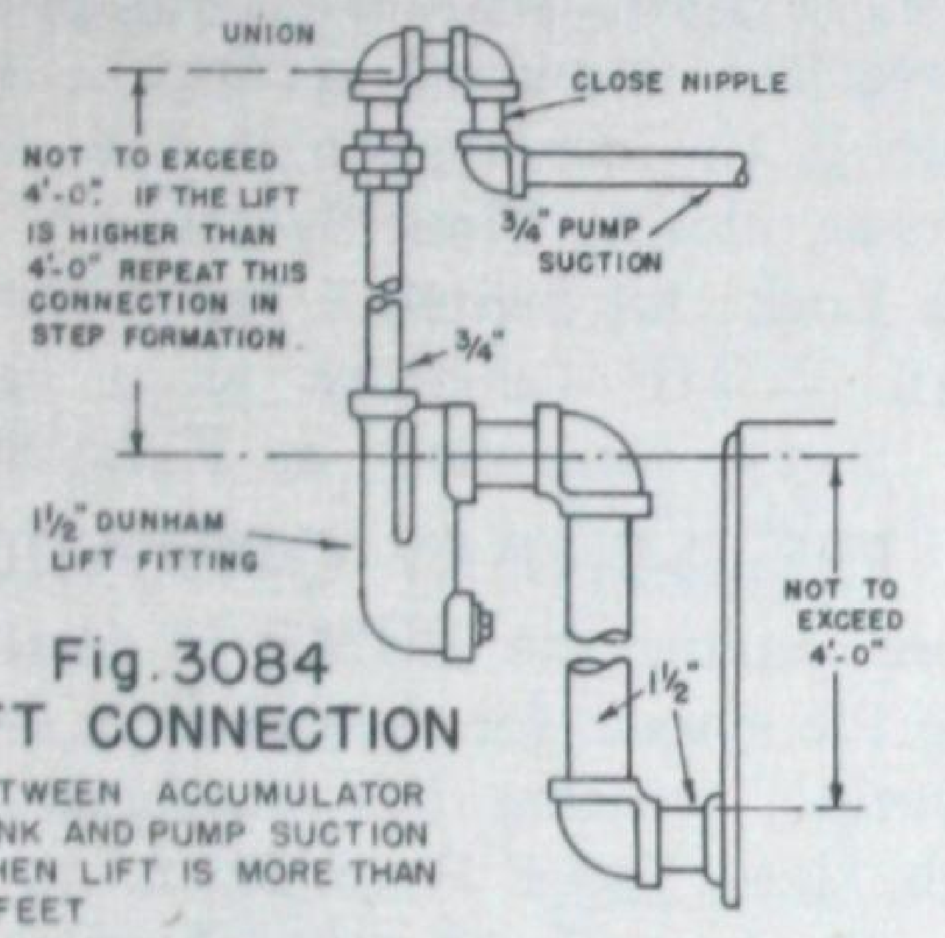

UNION
CLOSE NIPPLE
NOT TO EXCEED 4'-0" IF THE LIFT IS HIGHER THAN 4'-0" REPEAT THIS CONNECTION IN STEP FORMATION
3/4" PUMP SUCTION
3/4"
1½" DUNHAM LIFT FITTING
NOT TO EXCEED 4'-0"
1½"

Fig. 3084
LIFT CONNECTION
BETWEEN ACCUMULATOR TANK AND PUMP SUCTION WHEN LIFT IS MORE THAN 4 FEET

1. Discharge to boiler: Make connections from t discharge of PUMP to the boiler through the C eck Valve O, Rubber Connector Nipple and G te Valve G. Hartford Connection as shown i recommended by the Hartford Steam Boiler I spection and Insurance Co., Hartford, Conn., a d by the A.S.H and V.E.

2. Pump Suction: Connect suction of PUMP t the outlet connection of Accumulator Tank in m nner shown in Fig. 3083, with rubber con- n ctor nipple and Check Valve C next to PUMP. C nnections may be made according to Figs. 3085 3 4 to suit conditions prevailing.

3. Return Main: Connect the Return Main t the Accumulator Tank, installing Valves A a d B and Strainer D as shown.

4. By-Pass: When the lowest return is not l s than 18" above the boiler water line, install b -pass in return main with Check Valve E and Gate Valve F, furnished by the Heating Contractor, as shown, so that condensate can return to boiler by gravity in case of electric current failure. Boiler pressure should be reduced to a minimum for circulation and valves A, B closed.

5. Water Supply: Connect cold water supply to drain tapping of Air Separating Tank, leaving plugged tee for draw-off.

6. Base Drain: Run pipe from drain tapping in base to drain for drip from gland.

7. Air Vent: For Air Separating Tank: Air Vent V must be installed with Check Valve H above highest return but not less than 12" above boiler water line.

8. Air Vent: For Accumulator Tank: Extend air relief line L from vent tapping of Accumulator Tank to a point above highest return but not less than 12" above boiler water line and terminate with the Air Check R.

9. Vacuum Gauge and Vacuum Switch: Connect Air Relief Line L with Vacuum Switch through Stop Cock J. Also install Vacuum Gauge with gauge cock as shown.

10. Line Switch: A fused Line Switch shall be furnished by Heating Contractor and mounted on wall in a convenient location.

11. Starting Equipment: A Manual Starter with overload protection is supplied only with units to operate on 3 Phase Alternating Current. Mount on wall in location convenient to pump.

12. ALL PIPING MUST BE PROPERLY SUPPORTED BY HANGERS AND NOT SUPPORTED BY PUMP: Do not force connections as doing so may throw PUMP out of alignment. Remember, tight pipe joints secure best results.

13. DO NOT connect to PUMP any returns from equipment with open vents or from equipment or mains operating on a higher than heating system pressure, except through properly sized flash tanks and air check equipment, or as advised by our Engineering Department.

14. Wiring Connections: Follow wiring diagram furnished with pump unit.

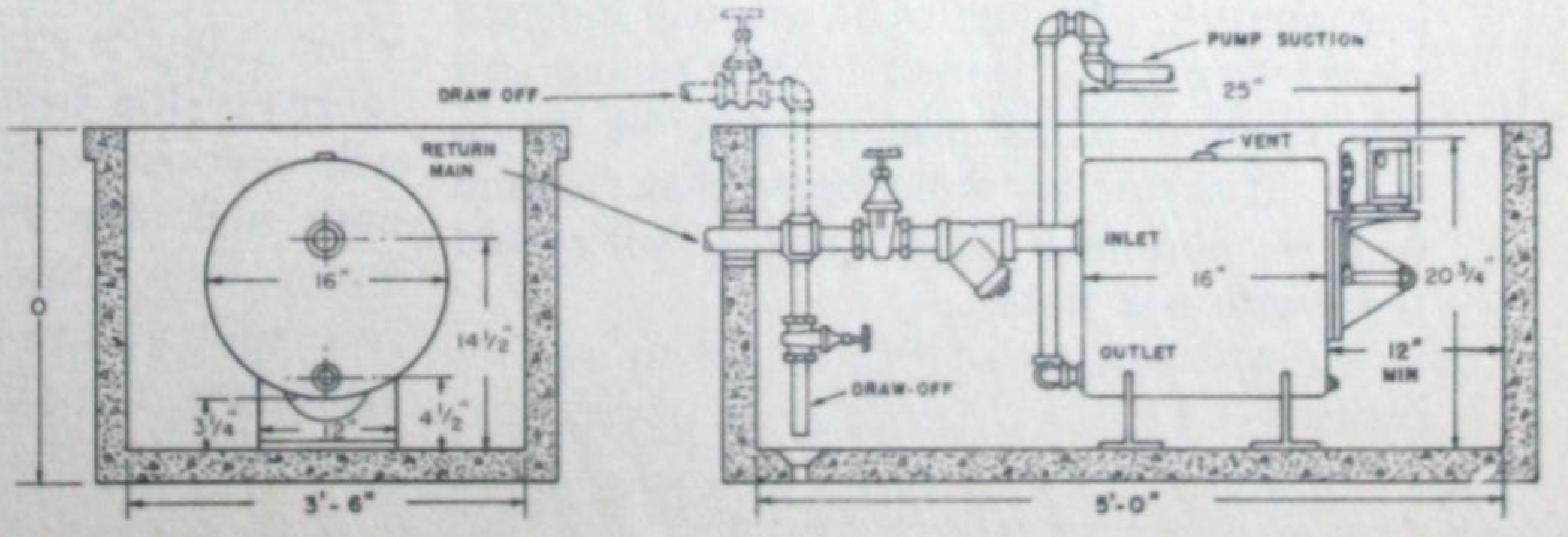


Fig. 3085
CCUMULATOR TANK DETAILS
AW-OFF CONNECTION SHOULD BE INSTALLED PIT ONLY WHEN PIT IS DRAINED TO SEWER; HERWISE OUTSIDE DRAW-OFF, SHOWN DOTTED OULD BE USED. DIMENSION "D", DEPTH PIT, TO SUIT CONDITIONS ON JOB.

OPERATION AND CARE

TRIAL OPERATION

For trial operation of the PUMP, proceed as follows:—

1. Lubricate the Pump and motor bearings (oil for the sleeve-bearing and grease for the ball-bearing). Cup T contains a lubricant for the PUMP packing. When necessary to refill, use only "John Crane Metal Plastic Packing Lubricant No. 3". This compound MUST NOT be used in any motor bearings or other pump bearings.
2. Fill Air Separating Tank with water until it shows half full in Gauge Glass M.
3. Turn the PUMP by hand by rotating coupling to determine that the shaft is not stuck by paint or motor is not out of line with PUMP.
4. Close Valve A and open Valve G.
5. Make sure wiring connections are complete between Line Switch, Vacuum Switch, Float Switch and PUMP motor (and Manual Starter on 3 Phase A.C. units).
6. Air Vent Check I must be installed and disc seating properly.
7. Close Stop Cock J in line to Vacuum Switch.
8. Throw Line Switch to "ON" position and place Lock Out Switch S to "ON" position.
9. Check direction of PUMP rotation, which should be as indicated by the arrow on PUMP oil well cover or on PUMP casing.
10. Make sure Packing Gland is not too tight; loosen if necessary. PUMP Gland should drip about 6 to 8 drops of water per minute when PUMP is running, to ensure proper lubrication.
11. Check PUMP pressure as shown by the Pressure Gauge. The pressure shown when Discharge Valve N is closed should be within 10% plus or minus, of the rated pressure shown on the nameplate.
12. PUMP should develop a high vacuum in a few minutes. Failure to do this will indicate loose connections around PUMP piping and Accumulator Tank which must be made tight. It should be remembered that vacuum will be obtained more quickly with cold than with hot water.

NORMAL SYSTEM OPERATION

Gate Valve A in return main and Stop Cock J in line to Vacuum Switch must be OPEN and Gate Valve B CLOSED. Line Switch must be in "ON" position and Lock Out Switch S in "ON" position. PUMP will run with a vacuum of 3″ or lower on the return main and stop when 7″ is reached (standard settings). PUMP will also run if the condensate in the Accumulator Tank rises, closing Float Switch.

With Lock Out Switch S set at "OFF" (night setting), PUMP functions as a condensation return pump, controlled by Float Switch only.

PRELIMINARY OPERATION

Before placing the PUMP in final operation, operate the system for several days,—(preferably two weeks), wasting the condensate to sewer through Gate Valve B to drain, to remove as much dirt, grease and other foreign matter as possible. When discharging condensate to sewer, supply make-up water to boiler to maintain proper water line.

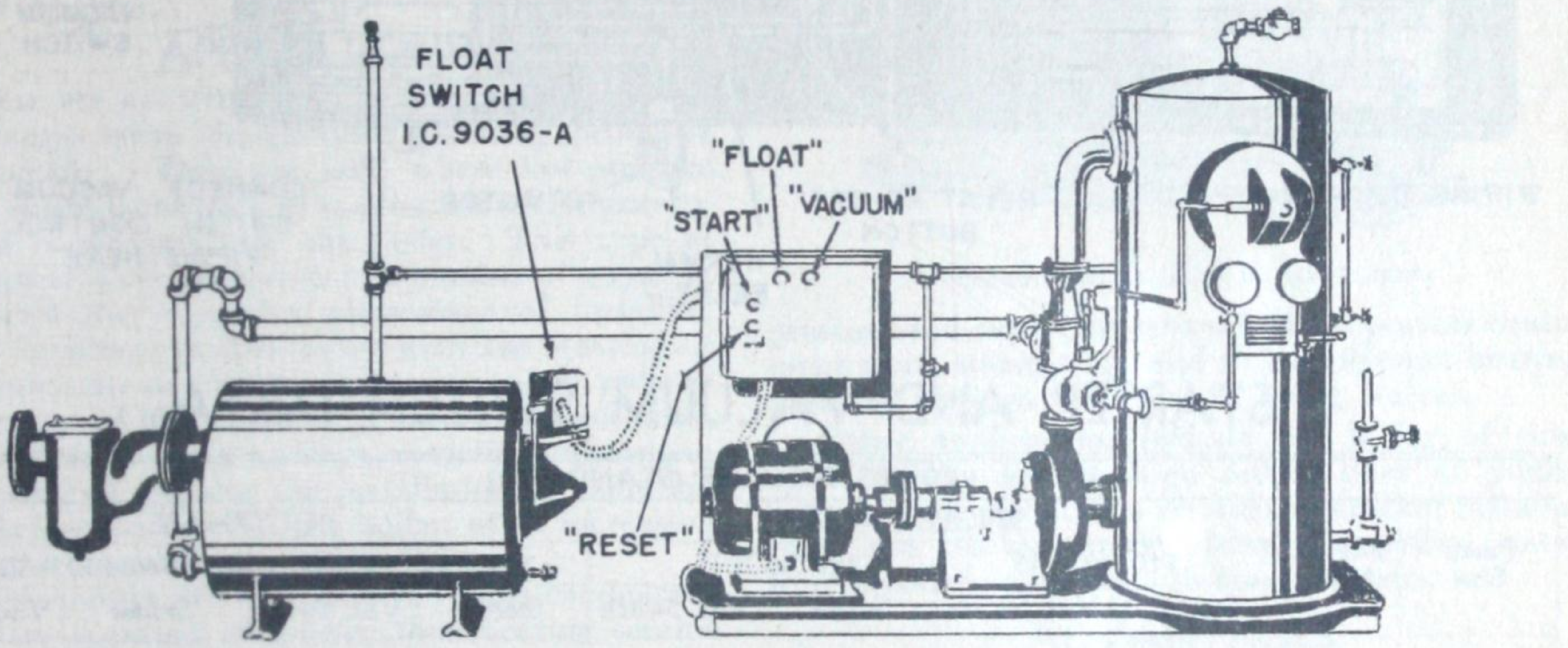
RE-ALIGNING PUMP AND MOTOR

If the PUMP binds when turned by hand, or is noisy, when operating, the motor may be out of alignment. To re-align the motor, loosen the four bolts in motor feet and shift the motor so that faces of the couplings are parallel with each other and edges true with each other, allowing sufficient play between faces for motor thrust. Be sure to retighten bolts in motor feet after aligning the motor. If, after re-aligning the motor and running the PUMP, noise starts upon retightening any bolt, place a shim under motor lug at that place before retightening.

CARE OF THE PUMP

Keep the motor and pump bearings well lubricated in accordance with instructions on Pump. Do not tighten gland too tight, allow about 6 drops of water per minute to leak through when Pump is running. This water is required to lubricate the bearings. If gland is too tight, it will overload motor, causing overload relays to open and stop Pump. If necessary to repack Pump, use Durametallic B110, which can be secured from the C. A. Dunham Co. Ltd. When tightening the Gland pull each nut up one-half turn alternately.

DUNHAM
VACUUM RETURN LINE HEATING PUMP ELECTRICAL STARTING EQUIPMENT
TYPE VR



he Pump Control Equipment is assembled ar furnished for Type VR Vacuum Pumps, si s VR2½ to VR65 inclusive. Pump Units u ig Motors 1½ H.P. and less are furnished with M nual Starting Switches. Pump Units with M tors larger than 1½ H.P. are furnished with M gnetic Starting Switches. All Starting S tches have overload protection and relay re t. The Starting Switches together with V uum Switch and Transfer Switch for changing fr n VACUUM to FLOAT control are assembled o Pump Control Panel, mounted on Pump base. A Float Switch is mounted on Accumulator T k. All are products of the Square D Company of anada Ltd. and made in Canada.

nternal wiring between Transfer Switch, V cuum Switch, Starting Switch and to Motor is c npleted at factory. Contractor will install service wiring to the Starting Switch and wiring from Float Switch to Terminal Block in Pump Panel, and must furnish a fused safety disconnect switch to accommodate fuses of capacity not greater than 3 times the full load amps of Motor.

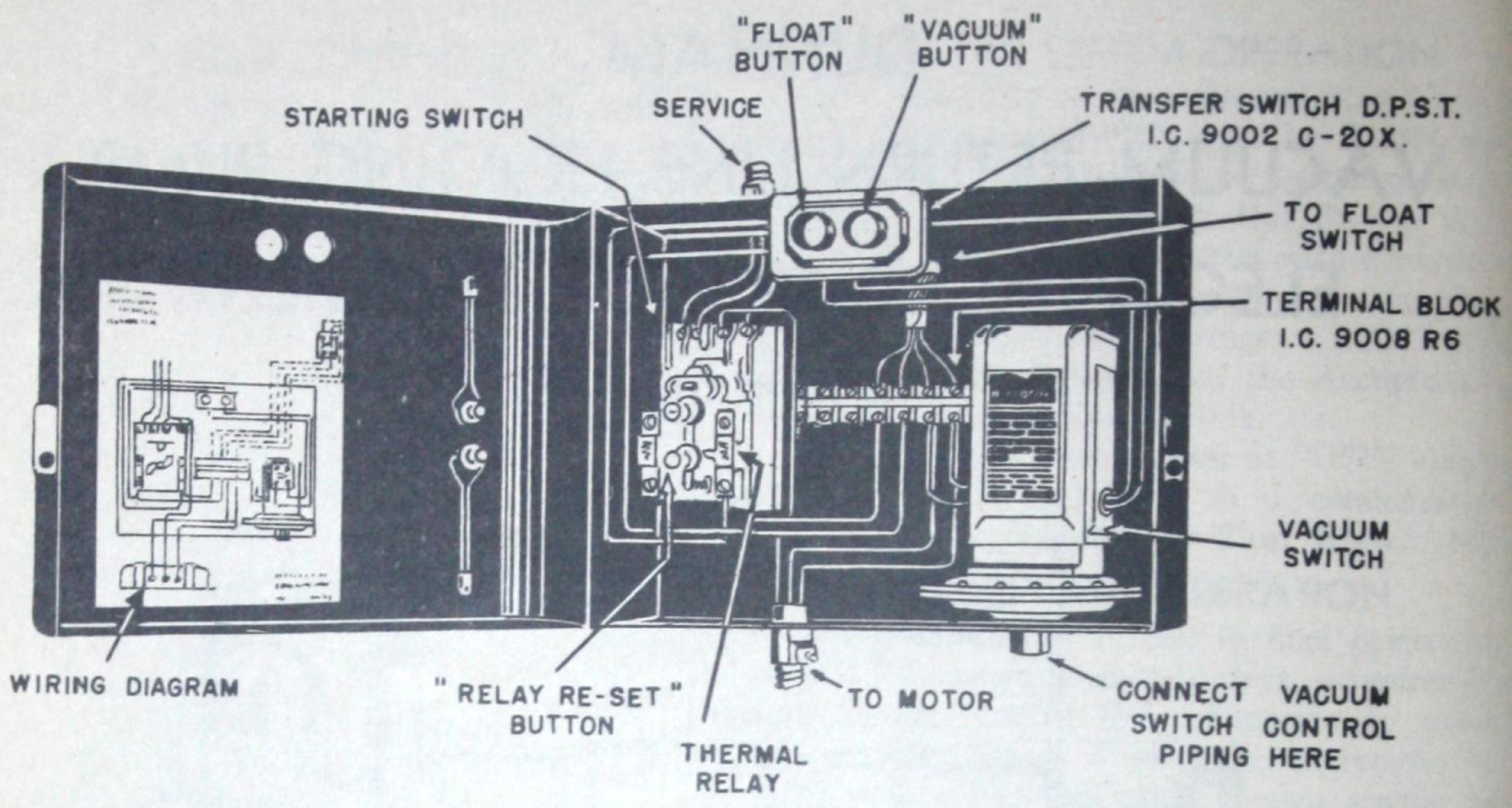
With Transfer Switch set at "VACUUM", the Pump will start with vacuum of 3″ or less on the returns and stop when 7″ is reached (standard settings). Pump also operates if condensate in Accumulator Tank rises, closing Float Switch.

With Transfer Switch set at "FLOAT" (normal night setting), Pump functions as a condensate return pump, being controlled by the Float Switch only.

See over for catalogue numbers of control equipment.

Repl es File No. 8B-6-1
Dated Apr. 15, 1941

Can. File No. 8B-6-1
Date: May 1, 1949



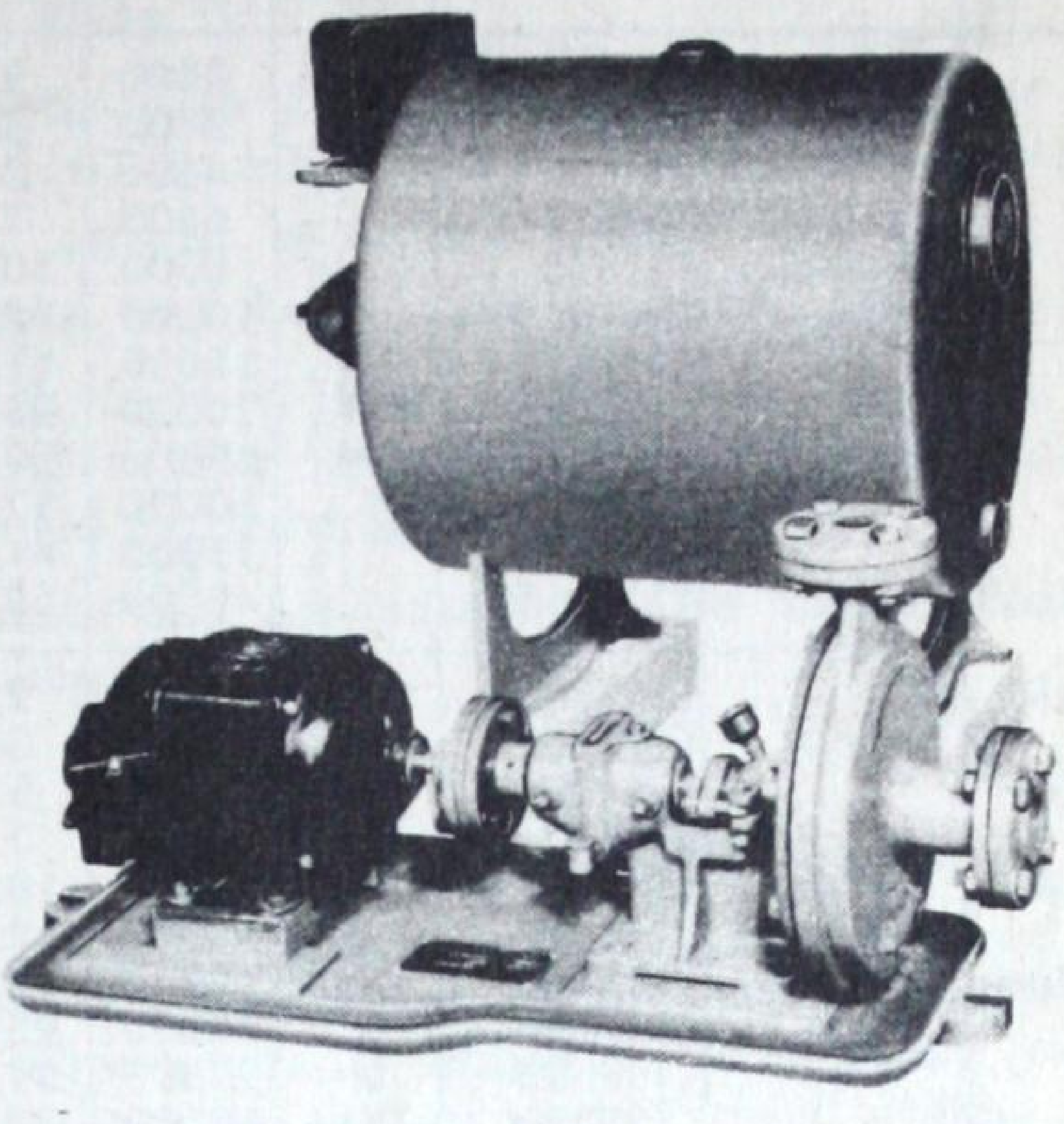
STARTER AND VACUUM SWITCH DATA.

Pump Size	Motor H.P.	SINGLE PHASE				POLYPHASE			
		110 VOLTS		220 VOLTS		208-220 VOLTS		440-550 VOLTS	
		Starter	Vac. Switch	Starter	Vac. Switch	Starter	Vac. Switch	Starter	Vac. Switch
20 LBS. PRESSURE (STANDARD)									
VR2½	¾	2510W5	9013V	2510W5	9013V	2510W5	9013V	2510W5	9013V
VR5	¾	2510W5	9013V	2510W5	9013V	2510W5	9013V	2510W5	9013V
VR10	1½	2510W5	9013V	2510W5	9013V	2510W5	9013V	2510W5	9013V
VR15	1½	2510W5	9013V	2510W5	9013V	2510W5	9013V	2510W5	9013V
VR20	2	8536TG2B	9100AV3	8536S18B	9100AV3	8536S18B	9100AV3	8536S18B	9100AV3
VR25	3	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR30	3	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR40	5	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR65	5	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
30 LBS. PRESSURE									
VR2½	2	8536TG2B	9100AV3	8536S18B	9100AV3	8536S18B	9100AV3	8536S18B	9100AV3
VR5	2	8536TG2B	9100AV3	8536S18B	9100AV3	8536S18B	9100AV3	8536S18B	9100AV3
VR10	3	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR15	3	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR20	5	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR25	5	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR30	7½	....	....	....	....	8636TG2B	9100AV3	8536S18B	9100AV3
VR40	7½	....	....	....	....	8536TG2B	9100AV3	8536S18B	9100AV3
VR65	7½	....	....	....	....	8536TG2B	9100AV3	8536S18B	9100AV3
40 LBS. PRESSURE									
VR2½	3	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR5	3	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR10	5	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR15	5	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR20	5	....	....	....	....	8536S18B	9100AV3	8536S18B	9100AV3
VR25	7½	....	....	....	....	8536TG2B	9100AV3	8536S18B	9100AV3
VR30	7½	....	....	....	....	8536TG2B	9100AV3	8536S18B	9100AV3
VR40	10	....	....	....	....	8536TG2B	9100AV3	8536TG2B	9100AV3
VR65	10	....	....	....	....	8536TG2B	9100AV3	8536TG2B	9100AV3

NOTE:—Starter Class I.C. 2510-W5 is Manual Starting Switch.
Starters Class I.C. 8536 are Magnetic Starting Switches.
Vacuum Switch Class I.C. 9013V is Diaphragm Type.
Vacuum Switch Class I.C. 9100AV3 is Bellows Type.

THE DUNHAM CONDENSATION PUMP AND RECEIVER

Dunham Condensation Pumps automatically urn water of condensation to boilers from gravity ating systems or steam process equipment or from nbinations of both types of load. They are cient, reliable and economical in operation. ey are a horizontal type pump and are designed discharge pressures from 15 to 30 pounds on cycle, A.C. and D.C. and from 15 to 30 pounds 25 or 50 cycle A.C. current. Their capacities nge from 2,000 to 40,000 square feet of Equivalent rect Radiation or from 3 to 60 U.S. Gal. per nute of water.



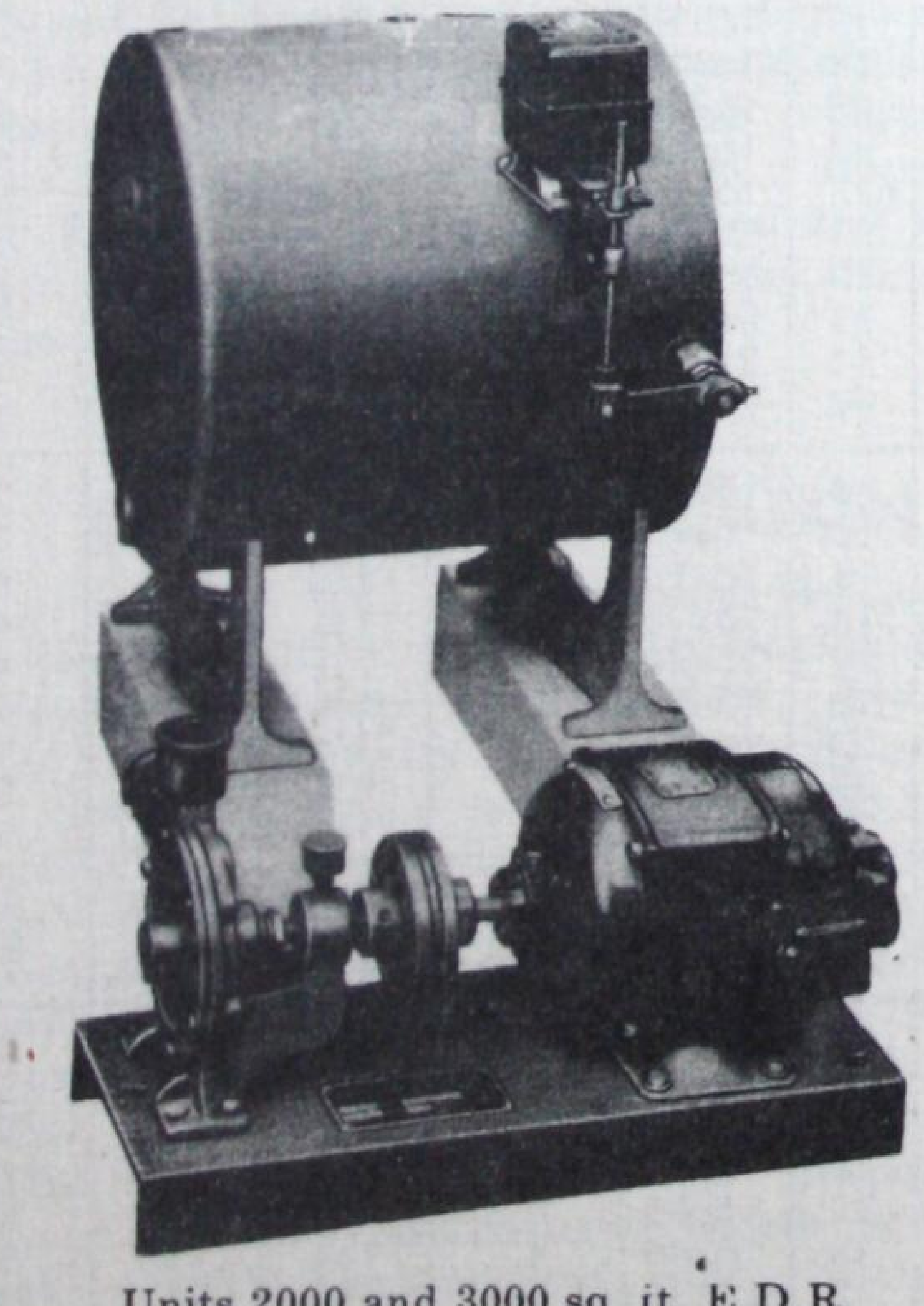
Units 4000 sq. ft. E.D.R. and larger.

APPLICATIONS

There are numerous applications in which Type I Pumps solve design and operating problems onomically. They are used where low-pressure turn mains come back at too low a level for gravity w of condensate into the boiler. This type of stallation is advantageous in a number of ways. It minates the expensive alternative of installing ilers in pits. It does away with the wasting of t condensate to sewers and thus saves fuel, reduces e amount of boiler make-up water required, minimizes difficulties from boiler encrustation and system rrosion and permits the installation of radiation or below the level of the boiler, often increasing e usable heated space in a building.

These pumps are also used to return condensate boilers operated at greater than heating service pressure and supplying steam both to process equipment using steam traps and to low-pressure heating systems through pressure reducing valves.

Other applications include the lifting of condensate from low to high return lines at points remote from the boilers on central station installations and the automatic lifting of overflow water from auxiliary apparatus to storage tanks.



Units 2000 and 3000 sq. it. E.D.R.

ADVANTAGES

(1) Small first cost.
(2) Low operating cost.
(3) Positive removal of condensate from system and automatic return to boilers.
(4) Accelerated steam circulation by permitting free drainage of condensate and venting of air from returns.
(5) Unusual requirements of space or design can be met by a flexible arrangement of the pump assembly which permits the placing of the receiving tank either adjacent to or remote from the pump.

CONSTRUCTION

The Type CH Pump is bronze-fitted and has a non-corrosive shaft. The case is of volute design. The impeller is of the enclosed type, hydraulically and dynamically balanced for high efficiency and long life. Bearings of liberal size insure maximum length of service with minimum attention.

The pump is driven by an electric motor direct-connected through a flexible coupling. The pump and motor are assembled as a unit on a rigid cast iron base. The Receiver Tank, equipped with float switch, is provided with saddles for mounting.

CAPACITIES OF TYPE CH PUMPS

Electrical Characteristics	Pressures	Pump Cat. No.	H.P. Motor	Pump Cap'y. Sq. Ft. E.D.R.	PumpØ Capacity G.P.M.		Receiver Capacity Gals.		Receiver Size	Connections-* Inches			Shipping Weight, Lbs., Approx.
					Imp.	U.S.	Imp.	U.S.		Receiver Inlet	Pump Suction	Pump Dis-Charge	
60 Cycle 1720 R.P.M. Motors	15 Lbs. Discharge Pressure	CH215	¼	2000	2.5	3	11	13	16x15	2	1	1	170
		CH315	¼	3000	3.7	4.5	11	13	16x15	2	1	1	170
		CH415	½	4000	5.0	6	11	13	16x15	2	1¼	1	360
		CH615	½	6000	7.5	9	12	14	16x16	2½	1¼	1	400
		CH815	½	8000	10.0	12	18	22	16x24	3	1¼	1	450
		CH1015	½	10000	12.5	15	18	22	16x24	3	1¼	1	450
		CH1515	¾	15000	17.5	21	27	33	16x36	4	1¼	1	500
		CH2015	¾	20000	25.0	30	27	33	16x36	4	1¼	1	500
		CH2515	¾	25000	29.15	35	27	33	16x36	4	1¼	1	500
		CH3015	1	30000	37.48	45	59	71	24x36	4	1½	1¼	550
		CH3515	1½	35000	41.65	50	59	71	24x36	4	1½	1¼	560
		CH4015	1½	40000	50.00	60	78	94	24x48	4	1½	1¼	575
	20 Lbs. Discharge Pressure	CH220	⅓	2000	2.5	3	11	13	16x15	2	1	1	180
		CH320	⅓	3000	3.7	4.5	11	13	16x15	2	1	1	180
		CH420	½	4000	5.0	6	11	13	16x15	2	1¼	1	400
		CH620	¾	6000	7.5	9	12	14	16x16	2½	1¼	1	450
		CH820	¾	8000	10.0	12	18	22	16x24	3	1¼	1	475
		CH1020	¾	10000	12.5	15	18	22	16x24	3	1¼	1	475
		CH1520	1	15000	17.5	21	27	33	16x36	4	1¼	1	525
		CH2020	1	20000	25.0	30	27	33	16x36	4	1¼	1	525
		CH2520	1	25000	29.15	35	27	33	16x36	4	1½	1¼	550
		CH3020	1½	30000	37.48	45	59	71	24x36	4	1½	1¼	550
		CH3520	1½	35000	41.65	50	59	71	24x36	4	1½	1¼	560
		CH4020	1½	40000	50.00	60	78	94	24x48	4	1½	1¼	575
	30 Lbs. Discharge Pressure	CH630	1½	6000	7.5	9	12	14	16x16	2½	1½	1¼	500
		CH830	1½	8000	10.0	12	18	22	16x24	3	1½	1¼	525
		CH1030	1½	10000	12.5	15	18	22	16x24	3	1½	1¼	525
		CH1530	1½	15000	17.5	21	27	33	16x36	4	1½	1¼	550
		CH2030	2	20000	25.0	30	27	33	16x36	4	1½	1¼	550
		CH2530	2	25000	29.15	35	27	33	16x36	4	1½	1¼	550
		CH3030	2	30000	37.48	45	59	71	24x36	4	1½	1¼	575
		CH3530	3	35000	41.65	50	59	71	24x36	4	1½	1¼	575
		CH4030	3	40000	50.00	60	78	94	24x48	4	1½	1¼	590
25 and 50 Cycle 1425 R.P.M. Motors	15 Lbs. Discharge Pressure	CH0215	¼	2000	2.5	3	11	13	16x15	2	1	1	170
		CH0315	¼	3000	3.7	4.5	11	13	16x15	2	1	1	170
		CH0415	⅓	4000	5.0	6	11	13	16x15	2	1¼	1	375
		CH0615	½	6000	7.5	9	12	14	16x16	2½	1¼	1	400
		CH0815	½	8000	10 0	12	18	22	16x24	3	1¼	1	450
		CH01015	¾	10000	12.5	15	18	22	16x24	3	1¼	1	475
		CH01515	¾	15000	17.5	21	27	33	16x36	4	1¼	1	500
		CH02015	¾	20000	25.0	30	27	33	16x36	4	1¼	1	500
		CH02515	¾	25000	29.15	35	27	33	16x36	4	1¼	1	500
		CH03015	1	30000	37.48	45	59	71	24x36	4	1½	1¼	550
		CH03515	1½	35000	41.65	50	59	71	24x36	4	1½	1¼	560
		CH04015	1½	40000	50.00	60	78	94	24x48	4	2	1½	575
	20 Lbs. Discharge Pressure	CH0220	⅓	2000	2.5	3	11	13	16x15	2	1	1	180
		CH0320	⅓	3000	3.7	4.5	11	13	16x15	2	1	1	180
		CH0420	½	4080	5.0	6	11	13	16x15	2	1¼	1	400
		CH0620	¾	6000	7.5	9	12	14	16x16	2½	1¼	1	450
		CH0820	¾	8000	10.0	12	18	22	16x24	3	1¼	1	475
		CH01020	¾	10000	12.5	15	18	22	16x24	3	1¼	1	475
		CH01520	1	15000	17.5	21	27	33	16x36	4	1¼	1	525
		CH02020	1	20000	25.0	30	27	33	16x36	4	1¼	1	525
		CH02520	1½	25000	29.15	35	27	33	16x36	4	1½	1¼	550
		CH03020	1½	30000	37.48	45	59	71	24x36	4	1½	1¼	550
		CH03520	1½	35000	41.65	50	59	71	24x36	4	1½	1¼	560
		CH04020	2	40000	50.00	60	78	94	24x48	4	2	1½	575
	30 Lbs. Discharge Pressure	CH0630	1½	6000	7.5	9	12	14	16x16	2½	1½	1¼	500
		CH0830	1½	8000	10.0	12	18	22	16x24	3	1½	1¼	525
		CH01030	1½	10000	12.5	15	18	22	16x24	3	1½	1¼	525
		CH01530	2	15000	17.5	21	27	33	16x36	4	1½	1¼	550
		CH02030	2	20000	25.0	30	27	33	16x36	4	1½	1¼	550
		CH02530	2	25000	29.15	35	27	33	16x36	4	1½	1¼	550
		CH03030	2	30000	37.48	45	27	33	16x36	4	1½	1¼	575
		CH03530	3	35000	41.65	50	59	71	24x36	4	1½	1¼	575
		CH04030	3	40000	50.00	60	59	71	24x36	4	1½	1¼	590
							78	94	24x48	4	1½	1¼	

ØAmount of Condensate the Radiation will condense in G.P.M.is one-third the Pump Capacity G.P.M.

GENERAL NOTES

*All connections of Receivers are tapped right ınd. Pump suction and discharge connections ·e flanged except on 2000 and 3000 square feet .D.R. units which have screwed connections ıpped right hand.

Pump units 4000 sq. feet E.D.R. and smaller ·e furnished with 16 in. x 15 in. Receiver. For 50 volts a 16 in. x 16 in. Receiver is supplied.

Strainer ("Y" Screwed) is supplied only on Jnits 2000 and 3000 Sq. Ft. E.D.R. and same size s Pump Suction.

Units consist of Pump and motor on base and Receiver with float switch and mounting saddles eady for piping and wiring connections.

DISCHARGE PRESSURES

In selecting Condensation or Vacuum Pumps, are should be taken to ensure choosing a Pump vith sufficient discharge pressure to more than qual the sum of the following resistances:

a) Boiler Pressure (Safety Valve blow-off pressure)
b) Height of Pump discharge or boiler water line above pump discharge outlet
c) Loss in head due to Friction of water in discharge pipe
(d) Loss in head due to Velocity

The discharge pressures listed for Type CH Condensation Pumps are the pressures at pump discharge outlet.

DUPLEX PUMPS

Type CH Pumps are available in duplex arrangement for services in which a standby unit is advisable to insure continuity of operation. Duplex CH Pumps are an assembly of two CH Pumps with a single Receiver Tank normally piped and wired to permit separate or simultaneous operation of the pumps.

SUGGESTED SPECIFICATION

Furnish and install, as directed by plans and manufacturer's instructions, one (or duplex) Dunham Condensation Pump and Receiver, size .... having a rated capacity of .... sq. ft. of equivalent direct radiation and capable of operating against a .... pound discharge pressure at the pump. (Each) Pump shall be driven by a direct connected, ... H.P. motor, of 40 degree rating, operating at a speed not in excess of 1750 RPM, and wound for .... volts, ... phase, ... cycles.

The Pump(s) shall consist of bronze-fitted, enclosed impeller centrifugal pump with non-corrosive shaft, motor and welded steel tank equipped with float switch and mounting saddles ready for piping and wiring.

ELECTRIC MOTOR DATA

Units of 2000 and 3000 sq. feet E.D.R. are furnished with single phase motors having overload protection built into the motors.

Motor starters are not supplied with single phase Units

Units with 2 H.P. motors or larger for single phase, A.C. must have a magnetic starter, as float switch will not carry the motor load. Starters supplied only at extra cost

All 2 or 3 phase units are supplied with manual motor starters with overload protection provided by thermal relays.

Units are not supplied with fused disconnect switches.

WARRANTY

Pumps are warranted by us to be free from defects in material and workmanship under normal use. This warranty obligates us to make good at our factory any part or parts thereof which, within one year after delivery of pump to the original purchaser, shall be returned to us with transportation charges prepaid and which our examination shall disclose to our satisfaction to have been defective. The warranty applying to motors and electrical equipment is that given by the manufacturers of this equipment.

OPERATION

Condensation from the heating or process system will flow by gravity into the Receiver of the pump. When the water line reaches sufficient height in the tank, float switch will close and operate the motor. The pump will quickly lower the water in the tank, discharging it to the boiler and will stop running when the float switch opens.

ORDERING

The sale and service of Type CH Pumps is in the hands of experienced Dunham Engineers who will gladly give full information and make studied recommendations on any project.

Orders should give the following information:

1. Catalog No.
2. Capacity in Sq. Ft. EDR
3. Discharge Pressure
4. Electrical Characteristics complete
    (a) Phase
    (b) Cycle
    (c) Volts—(one voltage)
5. Shipping Instructions
6. Any special billing instructions

USING STEAM IN INDUSTRY

Steam and water consumption by the steam-using equipment of industry can be substantially reduced by the use of a condensation and boiler feed pump instead of wasting condensate. The use of a boiler feed pump increases the capacity of the boiler about 20 per cent above that when cold city water is fed. Fuel consumption drops from 10 to 20%. Water consumption drops as much as 20 to 40% in small laundries, 2 to 5% in dairies. Amount of boiler compounds required drops about 90% and boiler encrustation is reduced.

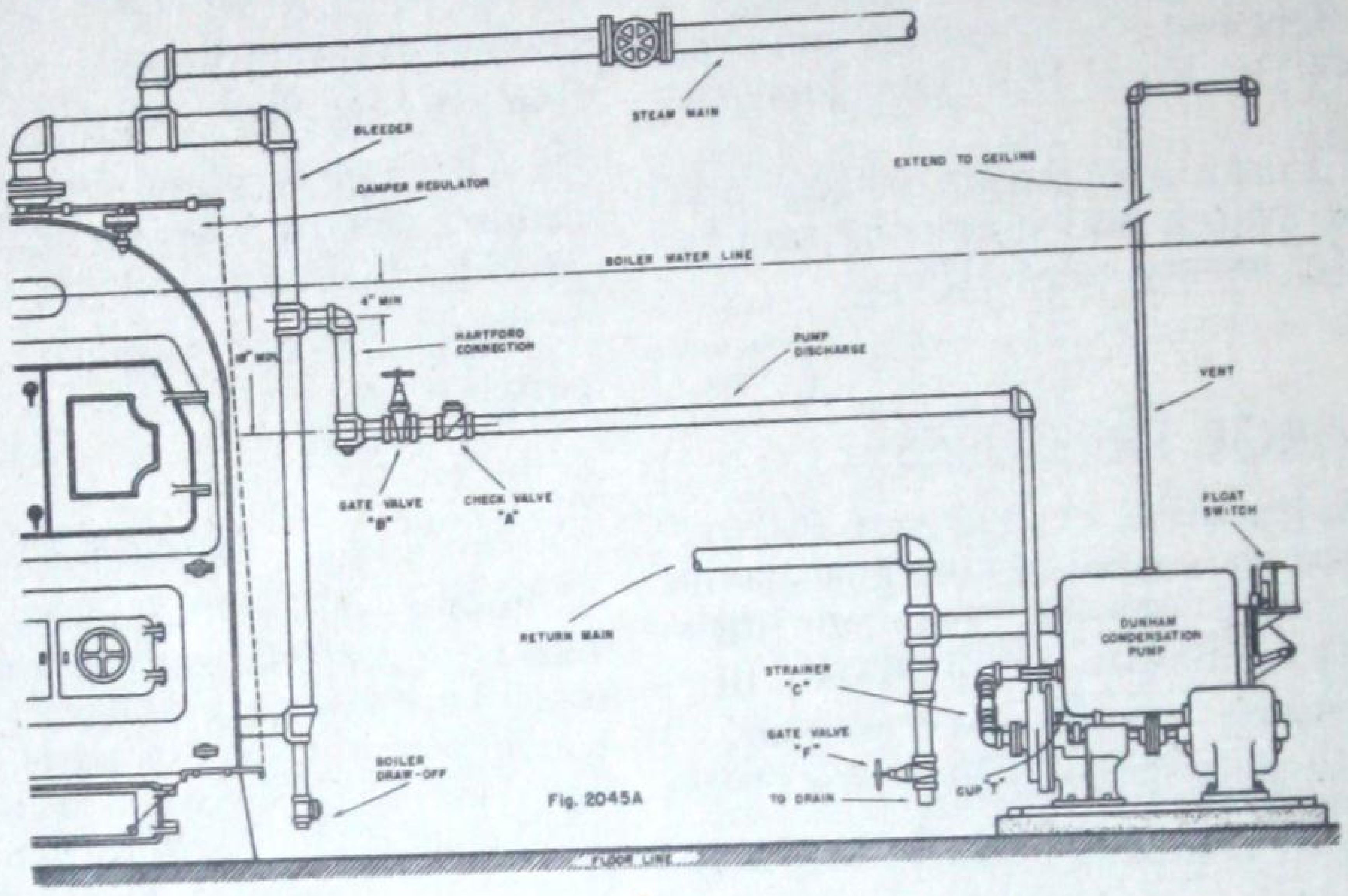


Fig. 2045A

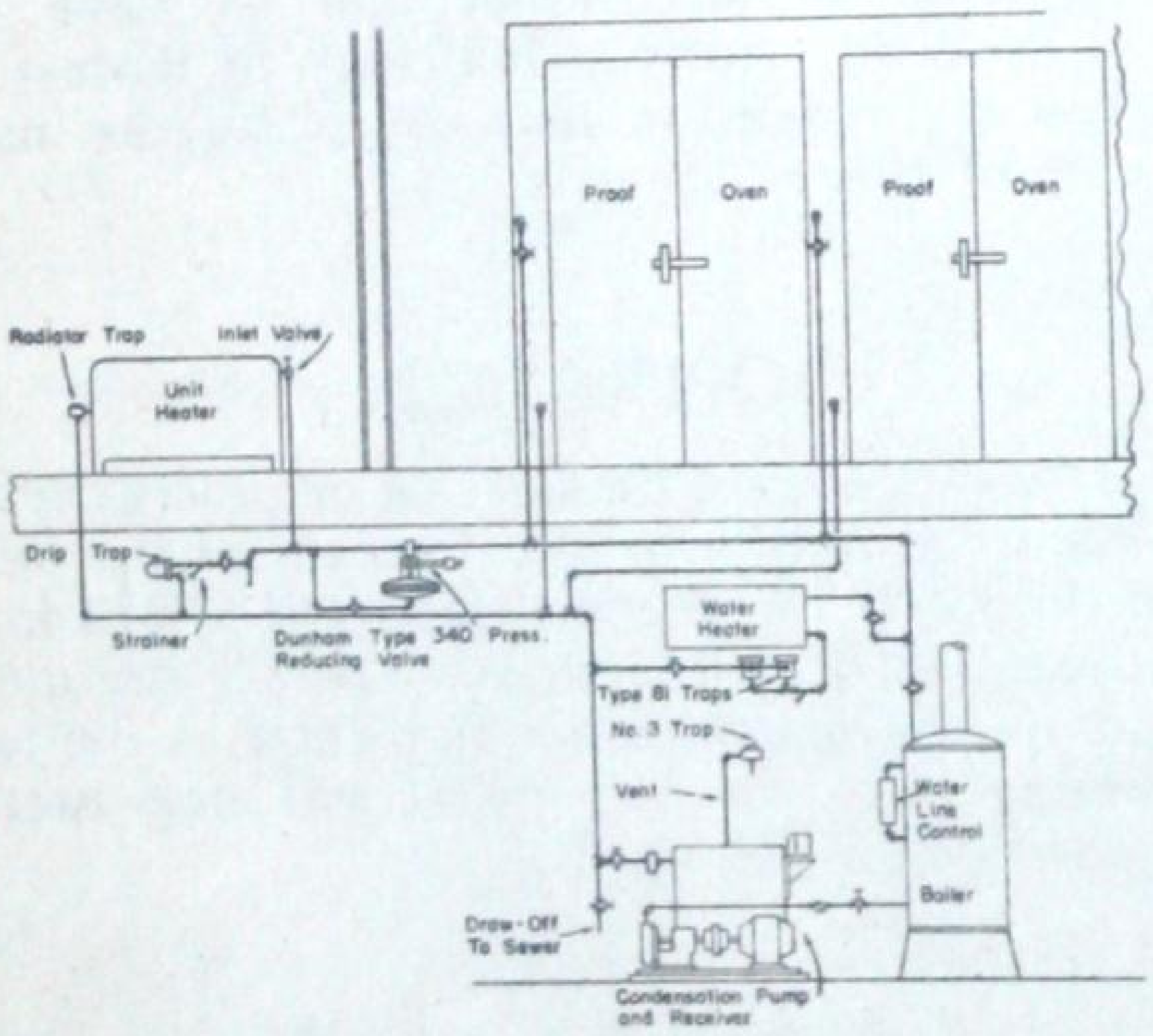


Fig. 1702A–A bakery arrangement in which steam at boiler pressure supplies a water heater and the coils of a proof oven. A single seated pressure reducing valve lowers the pressure of the supply to a Dunham cabinet type unit heater. Dunham High Pressure Traps are used on the high pressure service and Low Pressure Traps on the low pressure equipment. A condensation pump completes the cycle of flow back to the boiler.

APPROXIMATE STEAM CONSUMPTION

LAUNDRY EQUIPMENT

Appliance	Lb. Steam per hour
Washer (3 ft. diam.)	60
Washer (6 ft. diam.)	120
Starch Kettle (50 gal.)	60
Dry Room (per draw)	15
Mangle (4 ft.x8 ft.)	60
Soap Kettle (50 gal.)	60
Double Mangle (4 ft. x 8 ft.)	120
Cylinder—16-inch (8 ft. long)	30

KITCHEN EQUIPMENT

Appliance	Lb. Steam per hour	Appliance	Lb. Steam per hour
Coffee Urn (10 gal.)	30	Sterilizer Battery	90
Coffee Urn (5 gal.)	15	Dish Washers (single)	30
Steam Table	1.5*	Hot Water Tanks	30
Bain-Marie	1.5*	Potato Boilers	60
Vegetable Steamers	60	Soup Kettles	30
Stock Kettles	30	Jacketed Kettle (5 gal.)	15
Oyster Pots	15	Dish Washing Sink	30
Egg Boilers	15	Small Bean Warmer	15
Warming Ovens	30	Chocolate Urn	15
Plate Warmers	30	Silver Washing Jets	90

** Lb steam per square foot of heating coil surface per hour.*

DUNHAM CONDENSATION PUMP

TYPE CHE

D ham Type CH Model E Condensation Pumps are co plete, compact assemblies for removal of condensate fr n gravity heating systems, low pressure process ec pment or from combinations of both types of loads a automatic, positive return of water to low pressure b ers.

T y are moderate in initial cost and low in operating c s. By accelerating steam circulation in permitting f drainage of condensate and venting the air from th returns, they offer a satisfactory and economical s ution to many design and operating problems.

T y are used where low pressure return mains must b run at an elevation which does not permit gravity fl of condensate to the boiler, thus avoiding the e ense of installing the boiler in a pit. They eliminate th costly expedient of wasting hot condensate, thus sa ing fuel. The fuel saving is accomplished by reducin the amount of make-up water required, minimizing d culties from boiler encrustation. Their use often p mits increasing the usable heated space in a buildin by allowing the installation of radiation below the b er water level.

T ese pumps may also be used to lift condensate from l to high return lines at points remote from the b er and to lift overflow water from auxiliary apparat to storage tanks.

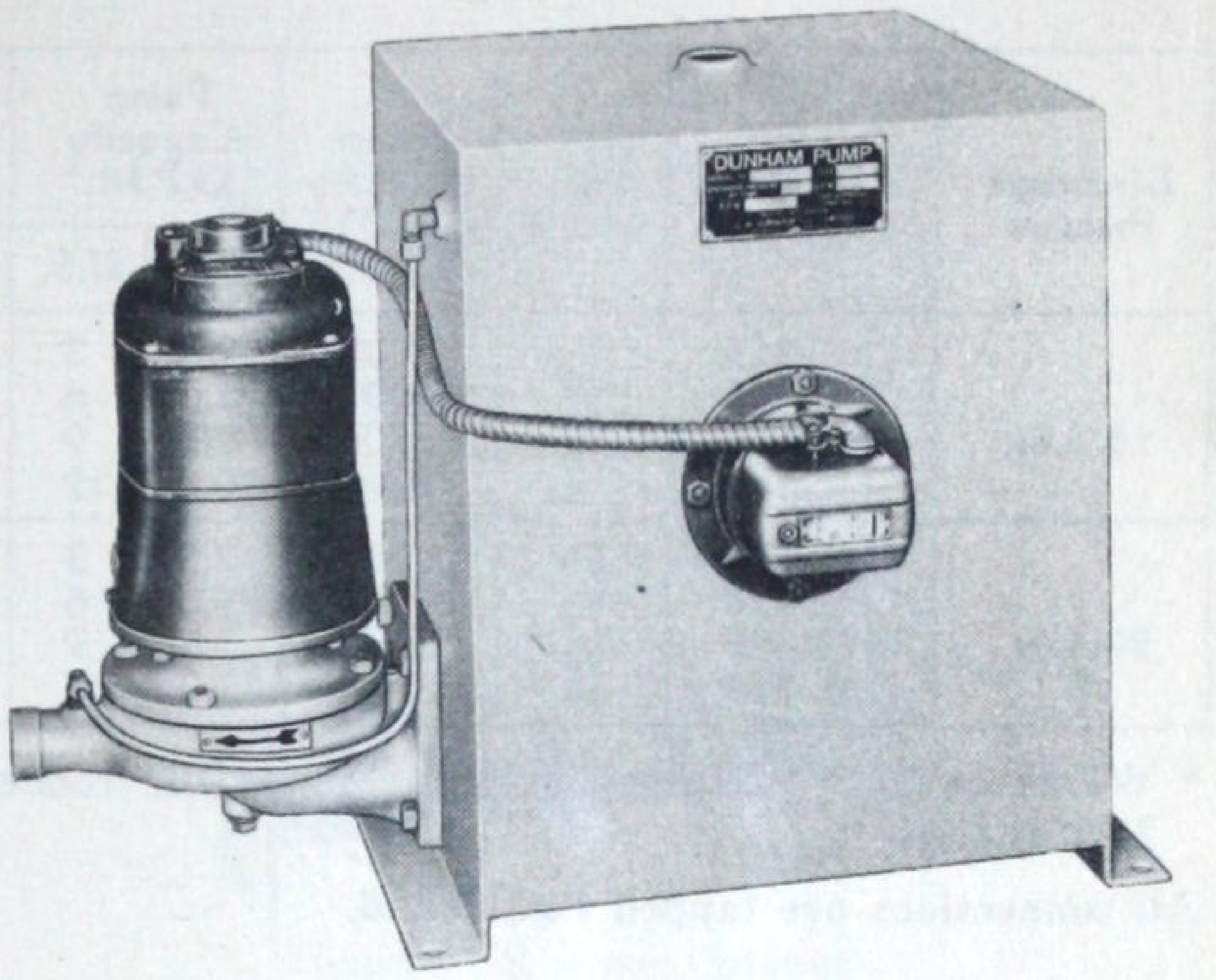
L NG LIFE

F a quarter of a century, the C. A. Dunham Company L ited has manufactured condensation pumps sound i engineering design, constructed of quality material, p duced by high manufacturing standards, which gives t m the stamina to stand up year after year with n mal attention.

T e centrifugal pump design is such that scale and r t in heating systems do not, by their abrasive action, s iously effect continuous pump efficiency. The motor m unting, located well above the floor level, affords i reased protection from splash, surface water and fl r cleaning operation.

S PERIOR PERFORMANCE

A tomatic, quiet, efficient and reliable performance d cribe the Dunham condensation pump's operation. T ability to handle condensate at high temperatures at r es several times the normal rate of heating system r quirements, insures dependable operation under all c ditions likely to be encountered on a job.



Type CHE Condensation Pump

EASY INSTALLATION

Type CHE pumps are complete with float switch, wired to motor at the factory. Substantially crated for protection in shipment, these pumps are ready for operation after piping is connected and wiring connections are made from electric service to motor.

CONSTRUCTION

The receiver, of welded construction, is made of heavy gauge copper bearing steel, with flanges on two sides for securely bolting the pump to the foundation. The receiver is equipped with a float switch.

The bronze fitted centrifugal pump with its hydraulically balanced enclosed impeller, is assembled as a unit on the end bracket of the electric motor. The pump case is of volute design. Drain plugs are provided in bottom of receiver and impeller casing.

The pump is equipped with a mechanical seal, eliminating leaking glands and the necessity of repacking. This mechanical seal is of proven performance over many years of service and is especially designed for heating pump service.

These pumps are available for operation on single phase, 60 cycle, 110/220 volt alternating current only. The motor speed is 3450 R.P.M. Motors are provided with ball bearings and have built in overload protection.

Can. File No. 8C-3-2
Date: Feb. 1, 1950

CAPACITIES OF TYPE CHE PUMPS

The capacity tables are arranged for readily selecting the proper unit for the E.D.R. load and discharge pressure. If the boiler is at a higher level or at some distance from the pump, care should be exercised to select a pump with sufficient discharge pressure to more than equal the maximum boiler pressure, plus the difference in elevation reduced to pounds (2.31 feet equals 1 pound) plus the friction in the discharge piping expressed in pounds. Frequently, the use of a larger discharge line will reduce the friction head discharge pressure.

Discharge Pressure	Pump Cat. No.	H.P. Motor	Pump Capacity Sq. Ft. E.D.R.	Pump Capacity G.P.M.*		Receiver Capacity Gals.		Receiver Size	Connections—Inches		Shipping Weight, Lbs., Approx.
				Imp.	U.S.	Imp.	U.S.		Receiver Inlet	Pump Discharge	
15 Lbs.	CHE-215	1/3	2000	2.5	3	14	17	12 x 16 x 20	2	1	140
	CHE-415	1/3	4000	5.0	6	14	17	12 x 16 x 20	2	1	145
	CHE-615	1/2	6000	7.5	9	18	22	16 x 16 x 20	2½	1	150
	CHE-815	1/2	8000	10.0	12	18	22	16 x 16 x 20	2½	1	160
20 Lbs.	CHE-220	1/3	2000	2.5	3	14	17	12 x 16 x 20	2	1	140
	CHE-420	1/3	4000	5.0	6	14	17	12 x 16 x 20	2	1	145
	CHE-620	1/2	6000	7.5	9	18	22	16 x 16 x 20	2½	1	150
	CHE-820	1/2	8000	10.0	12	18	22	16 x 16 x 20	2½	1	160

* Water capacity of pump is three times the condensing rate of system having same E.D.R. load as pump E.D.R. capacity.

All connections are tapped right hand.

DIMENSIONS

DIMENSIONS—INCHES		
Dimension Key	Pump Catalogue Number	
	CHE-215, CHE-220 CHE-415, CHE-420	CHE-615, CHE-620 CHE-815, CHE-820
A	16	16
B	12	16
C	8	8
D	16 5/16	18 5/16
E	7¾	9¾
F	14¼	18¼
G	14½	14½
H	24 1/16	28 1/16
J	15½	19½

We reserve the right to change, without notice, dimensions and specifications which will be verified on request.

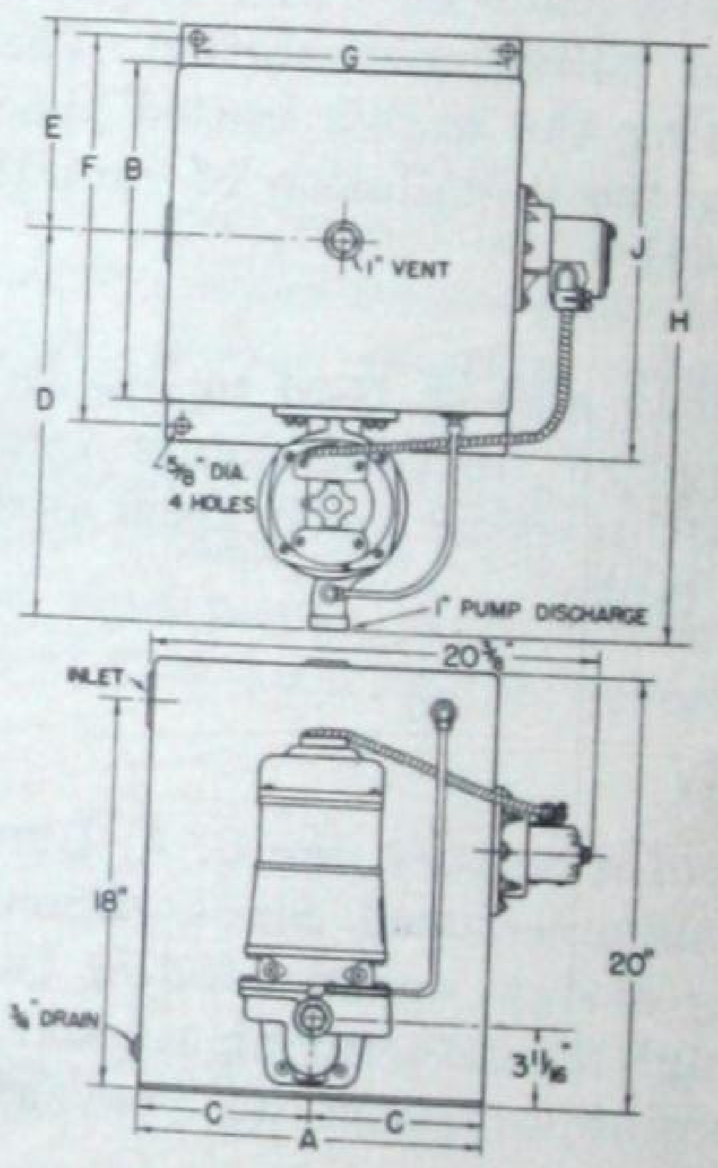


Fig. 4017

OPERATION

Condensate from the system flows by gravity into the pump receiver. When the water level reaches sufficient height, the float mechanism closes the float switch contacts and operates the motor. The pump discharges the water to the boiler and lowers the level in the receiver. The pump stops when the water in the receiver reaches its low level where the float mechanism opens the float switch contacts.

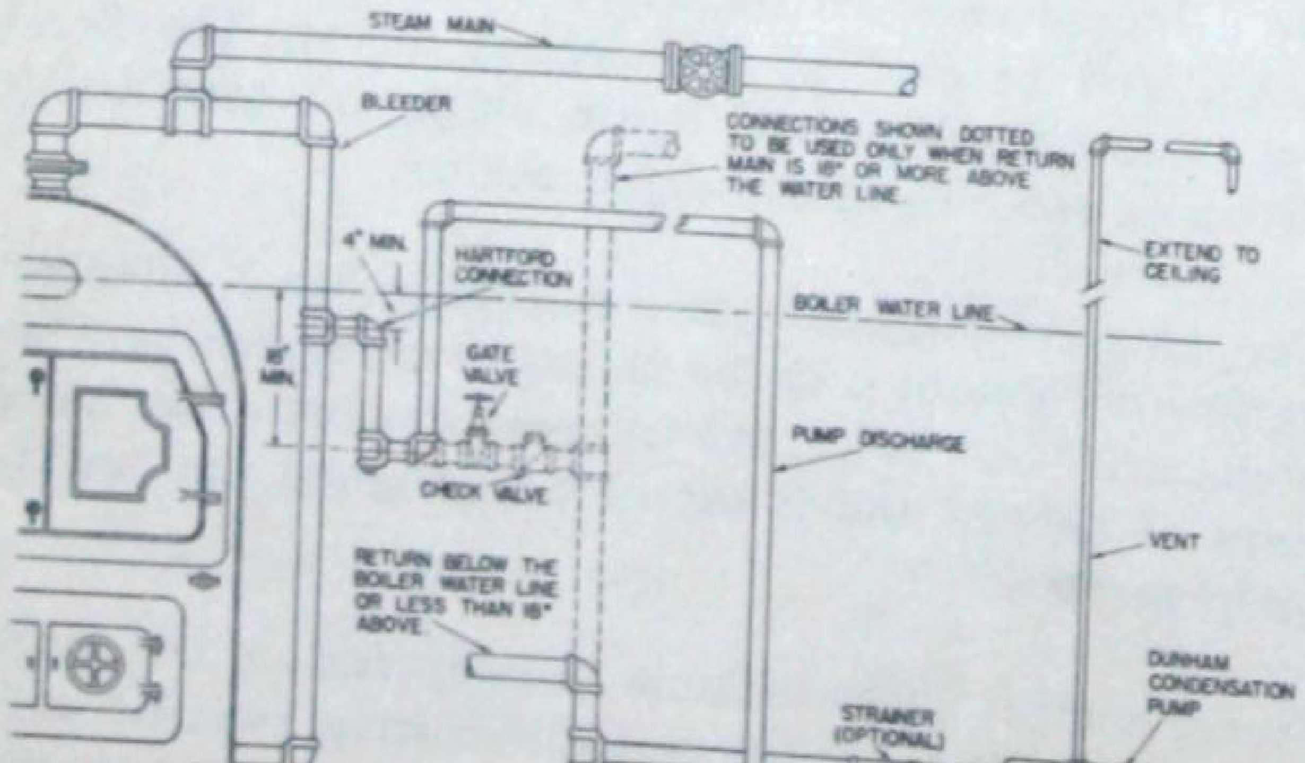
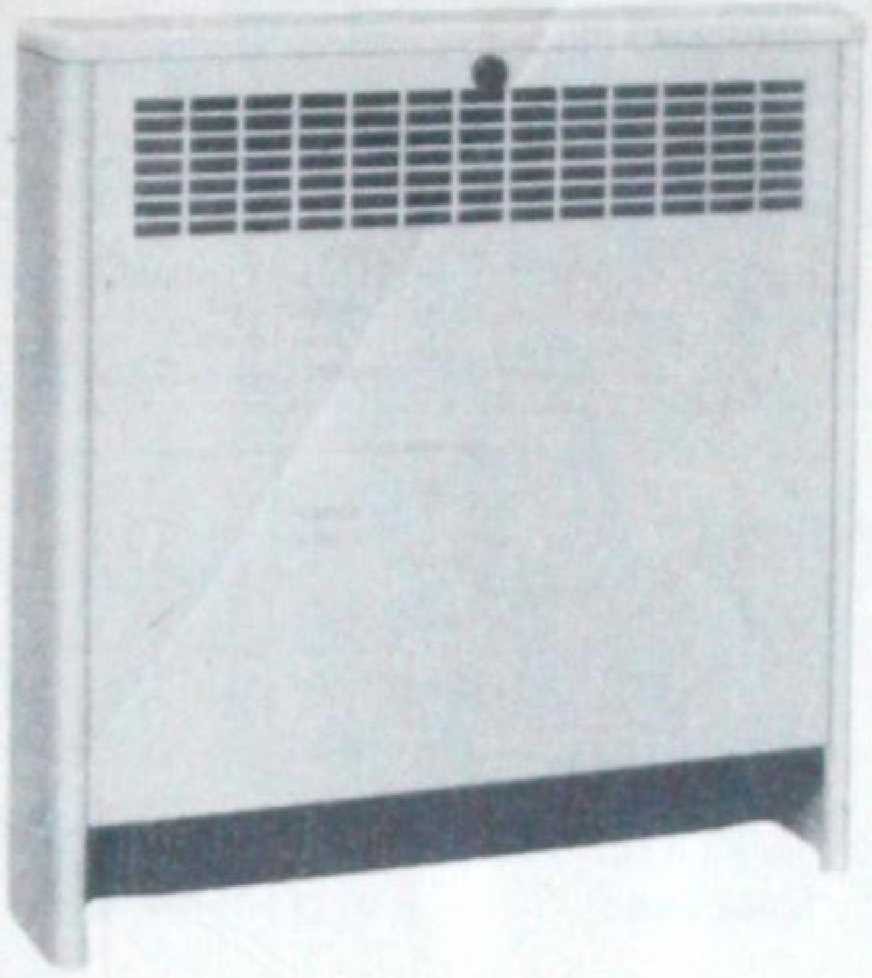


Fig. 4018—Typical Condensation Pump Installation

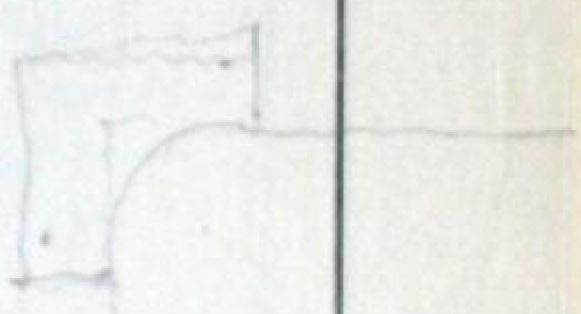
DUNHAM
CABINET CONVECTOR RADIATORS

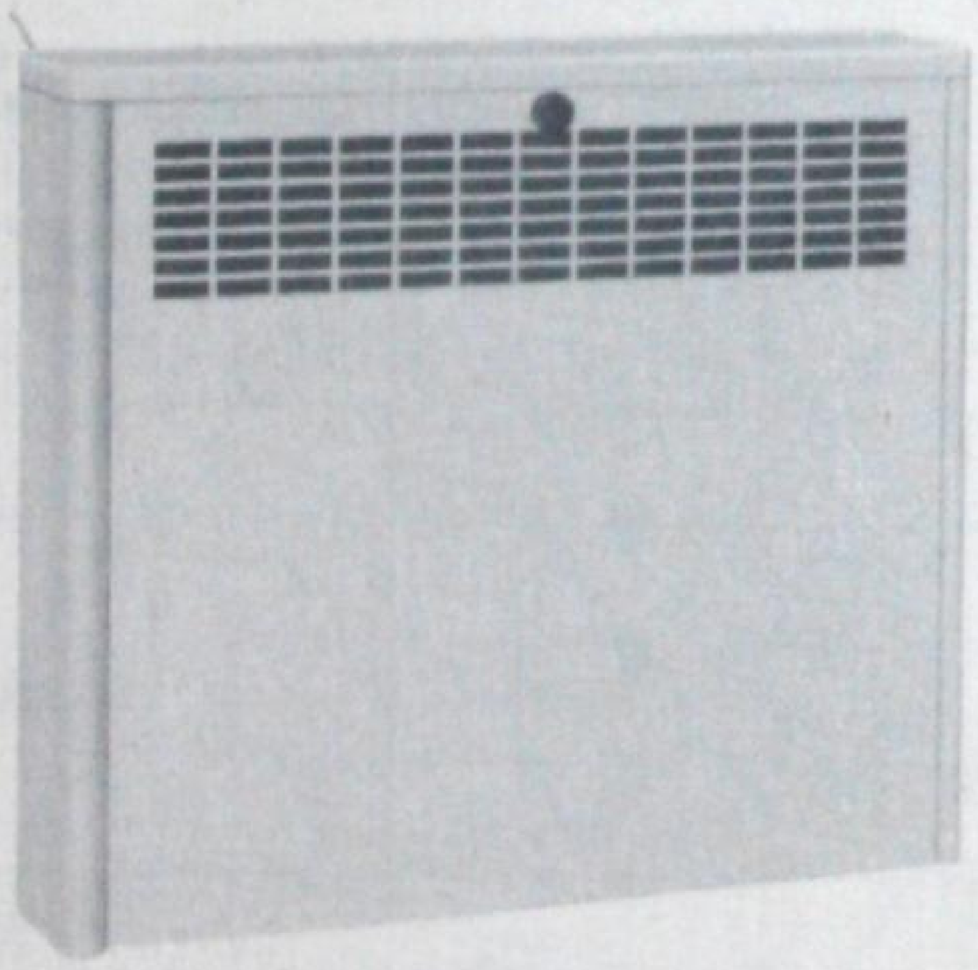
TYPES FCE, FCOE AND WCE

Th Dunham Cabinet Convector Radiators, Ty es FCE, FCOE and WCE, are complete he ing units and include heating elements and ca nets. Front outlet dampers are provided wh n so ordered. The floor cabinets are desig ed so that they may be fully exposed or pa ially recessed within the wall. For partially re ssed applications the wall surface of the re ss should be insulated, but additional metal lin s are not required. Recesses made for ca nets should have $1/8''$ clearance at the sides an top of cabinet with wood moulding trim ap ied on face of wall around the joint of re ss and cabinet.



Type FCE Floor Cabinet





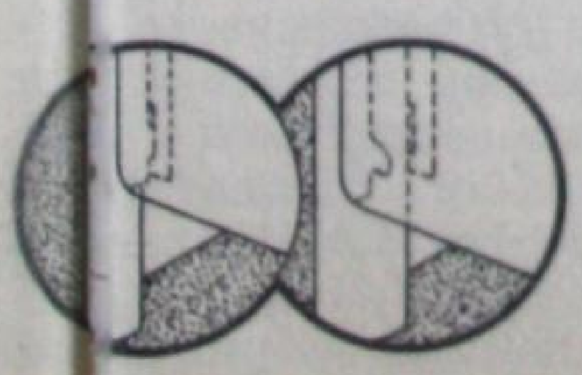
Type WCE Wall Cabinet

CONSTRUCTION

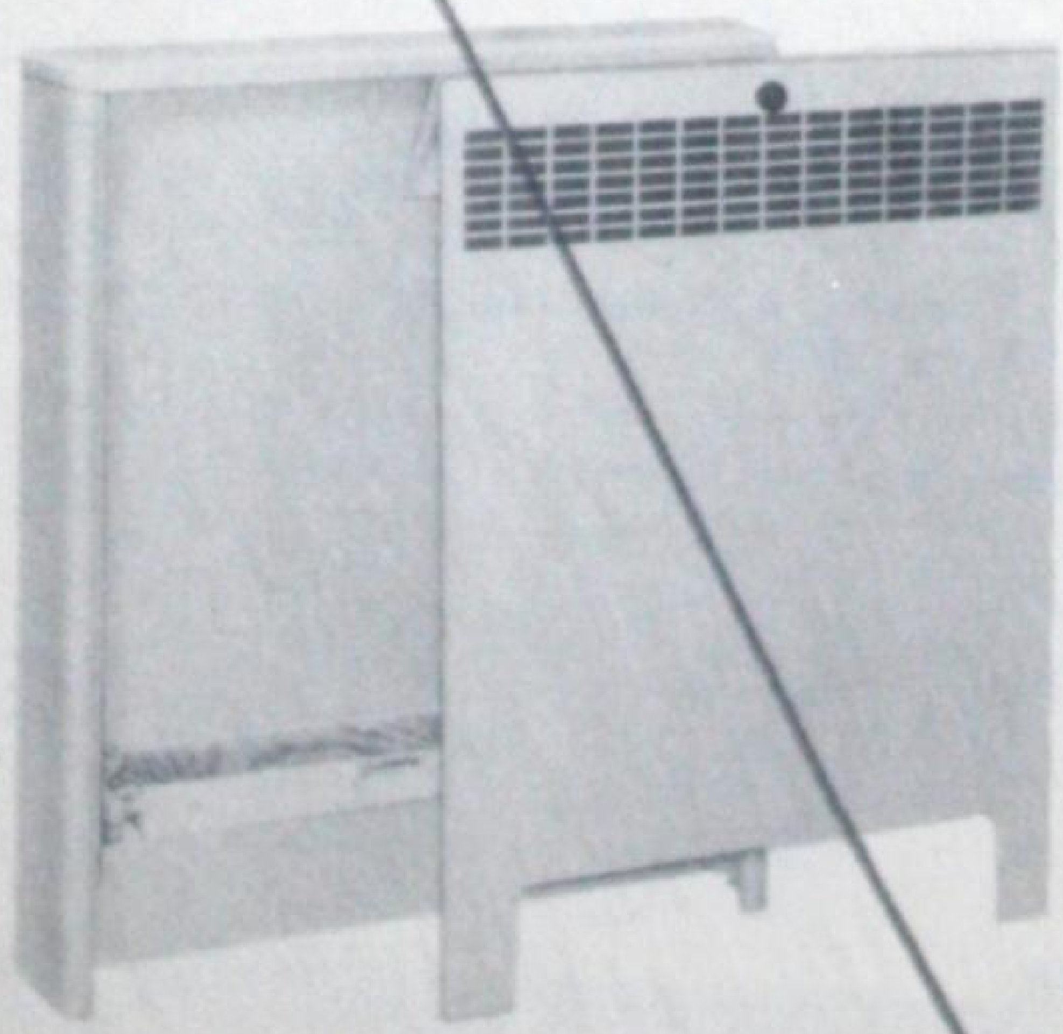
Cabinets are fabricated of sheet steel of quality and gauge which produce a product with all the physical characteristics of fine metal furniture. No bolts, screws or rivets mar the smooth exterior surfaces. Columnar forming of the sides, rounded corners and interior reinforcements produce an exceptionally rugged and rigid assembly. Cabinets are equipped with suitable supports for the heating elements to simplify installation. Dampers, when ordered, are built as an integral part of the removable front panel.

TH REMOVABLE FRONT

Ac ssibility is a particularly desirable feature in nvectors to simplify installation and periodi cleaning of heating element and enclosure int rior. Dunham Cabinet Convectors provide acc ssibility by an easily removable front panel. A upward, outward and downward movement of e bottom of the panel is all that is required to ree the panel. It can be replaced with equal sim licity.



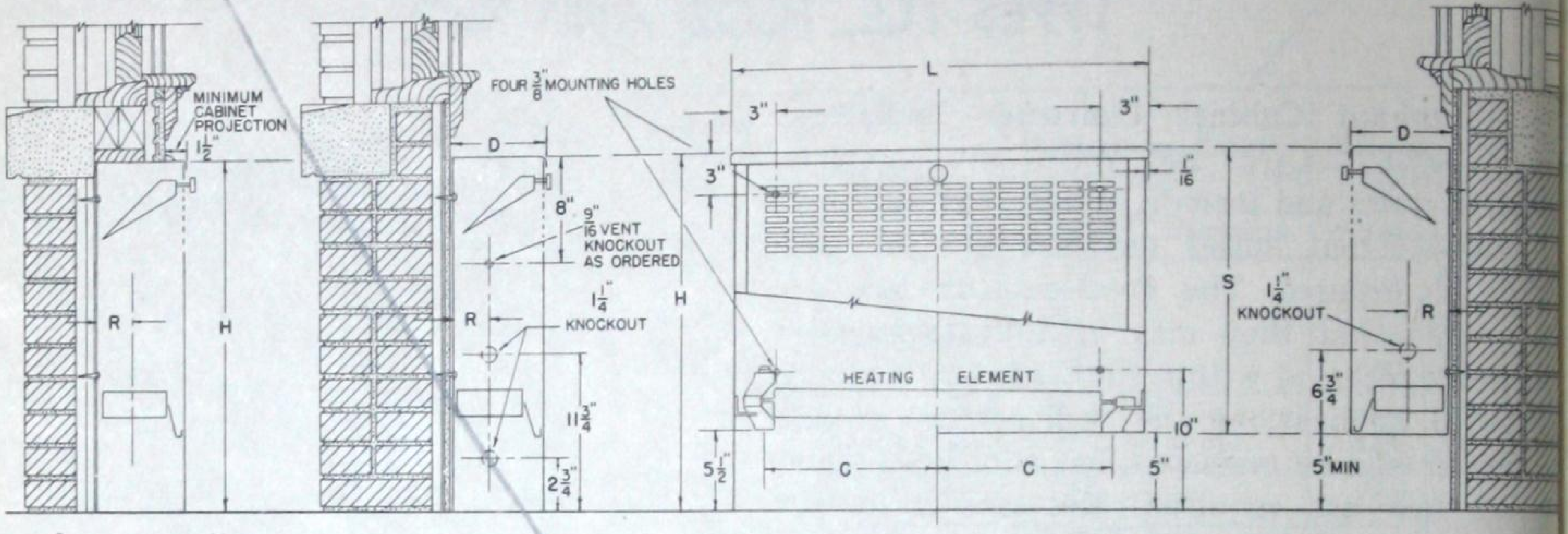
FRONT PANEL CATCH
Fig. 3109
Facilitates ready removal and replacement of the front panel of Cabinet Convectors



Type FCOE Floor Cabinet
with front removed

DIMENSIONS AND INSTALLATION DATA

TYPES FCE, FCOE AND WCE



Types FCE-FCOE Partially Recessed

Types FCE-FCOE Fully Exposed

Fig. 3194

Type WCE Fully Exposed

LENGTH													
Ordering Length Reference		14	18	22	26	30	36	42	48	54	60	66	72
"L"	Overall Length	14⅛"	18⅛"	22⅛"	26⅛"	30⅛"	36⅛"	42⅛"	48⅛"	54⅛"	60⅛"	66⅛"	72⅛
"C"	Tapping Centres	5"	7"	9"	11"	13"	16"	19"	22"	25"	28"	31"	34"

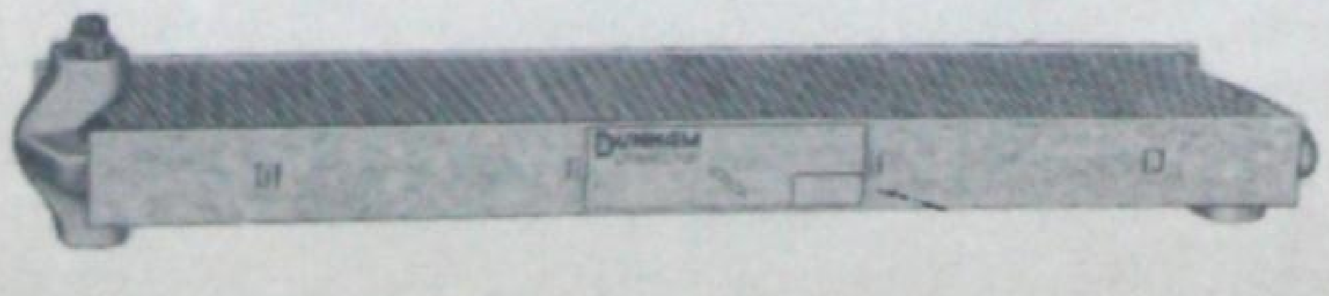
Recess Length, FCE and FCOE Units = "L" plus ⅛". All Tappings ¾".

DEPTH					
Ordering Depth Reference		3E	5E	7E	10E
"D"	Cabinet Depth	4½"	6¼"	8"	11½"
"R"	Tapping Centre	2"	2⅞"	3¾"	5½"
Maximum Recess Depth		3"	4¾"	6½"	10"

HEIGHT					
"H"	Ordering & Actual Height Types FCE and FCOE	20"	23"	26"	32"
"S"	Ordering & Actual Height Type WCE	15"	18"	21"	27"

Recess Height, FCE and FCOE Units = "H" plus ⅛."

HEATING ELEMENT



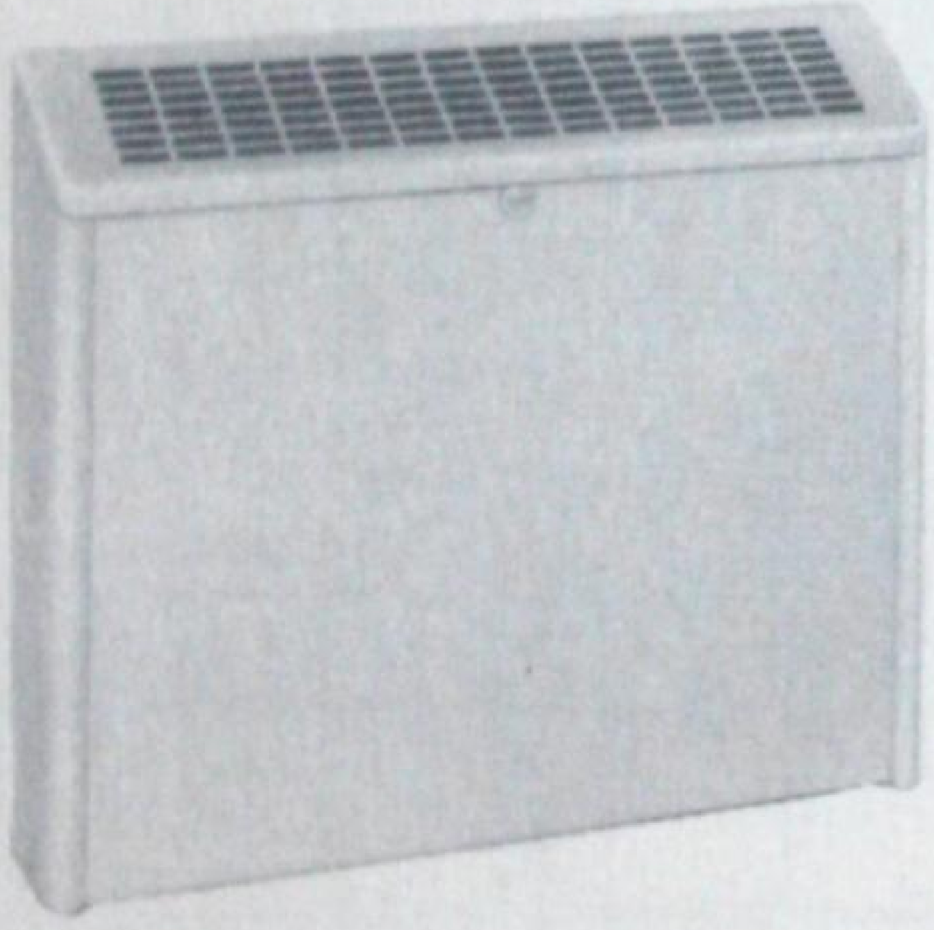
The Dunham Convector uses an all-non-ferrous-all heating element. It is uniquely resistant to corrosi and its smooth surfaces do not encourage dust a hesion. Fins are assembled on copper tubes which a welded into bronze supply and return headers. Supp headers are tapped top and bottom, return heade bottom only. Galvanized steel strips along each si protect fins from damage during shipment and stallation.

DUNHAM CABINET CONVECTOR RADIATORS

TYPES FCSE, FCSOE AND WCSE

The Dunham Cabinet Convector Radiators, Types FCSE, FCSOE and WCSE, are complete heating units and include heating elements and cabinets. Front outlet dampers are provided when so ordered. They are designed with sloping tops and intended for fully exposed installation only. They meet the desire for top outlet units. The sloping top ensures that the outlet grille will be kept free of obstructions. The wall cabinet has back and sides finished flush with the bottom of the removable front and is mounted with the bottom a minimum of 5" above the finished floor.

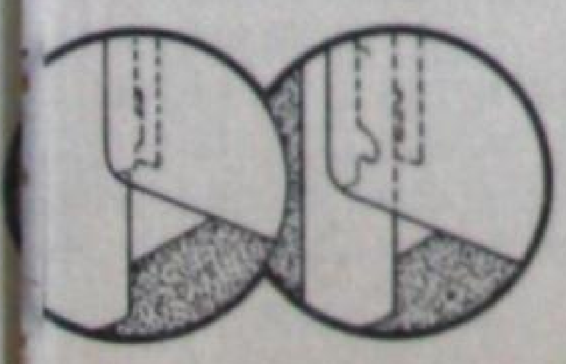
Type FCSE, Floor Cabinet



Type WCSE Wall Cabinet

THE REMOVABLE FRONT

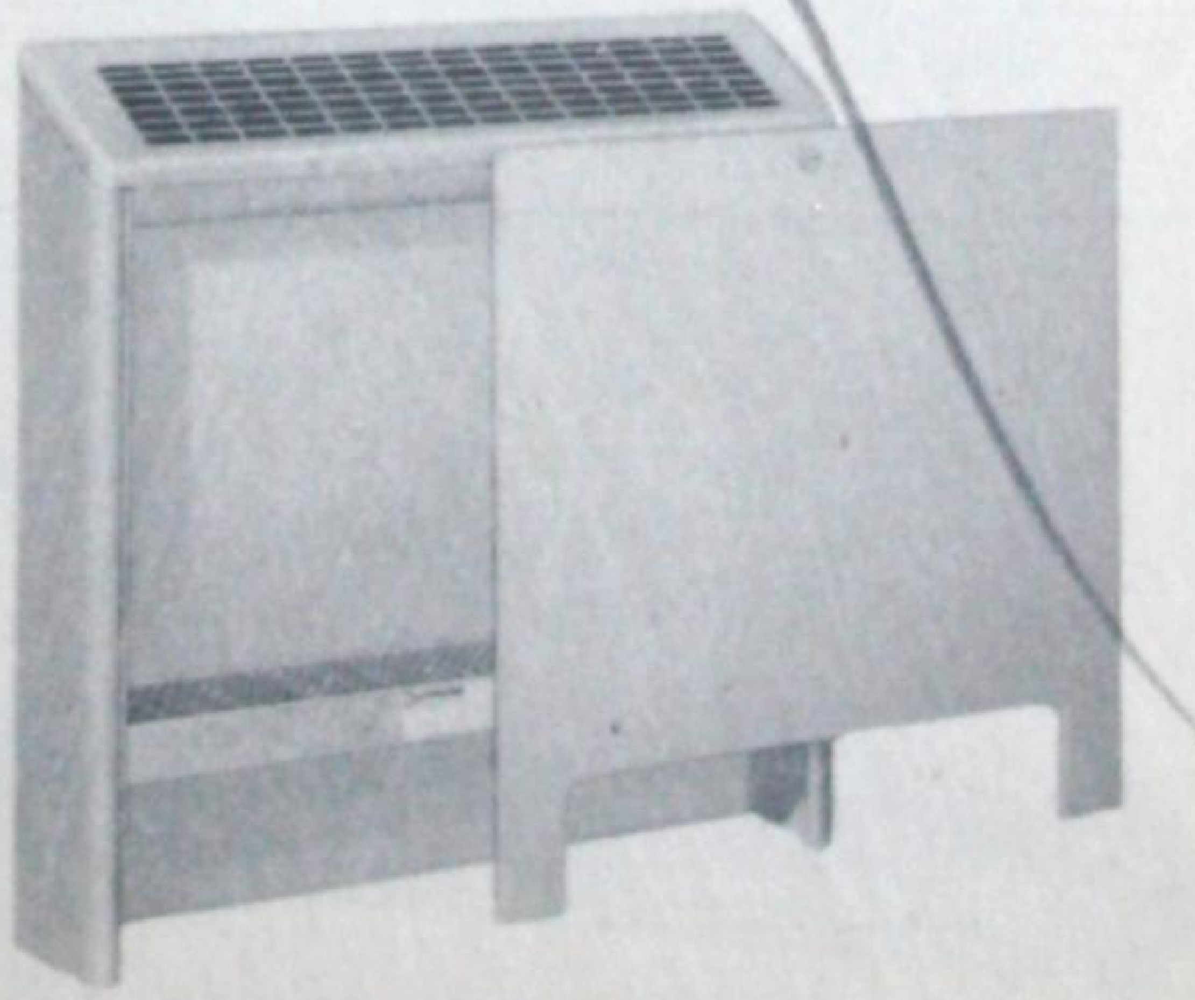
Accessibility is a particularly desirable feature in convectors to simplify installation and periodic cleaning of heating element and enclosure interior. Dunham Cabinet Convectors provide accessibility by an easily removable front panel. An upward, outward and downward movement of the bottom of the panel is all that is required to free the panel. It can be replaced with equal simplicity.



FRONT PANEL CATCH
Fig. 3109
Facilitates ready removal and replacement of the front panel of Cabinet Convectors

CONSTRUCTION

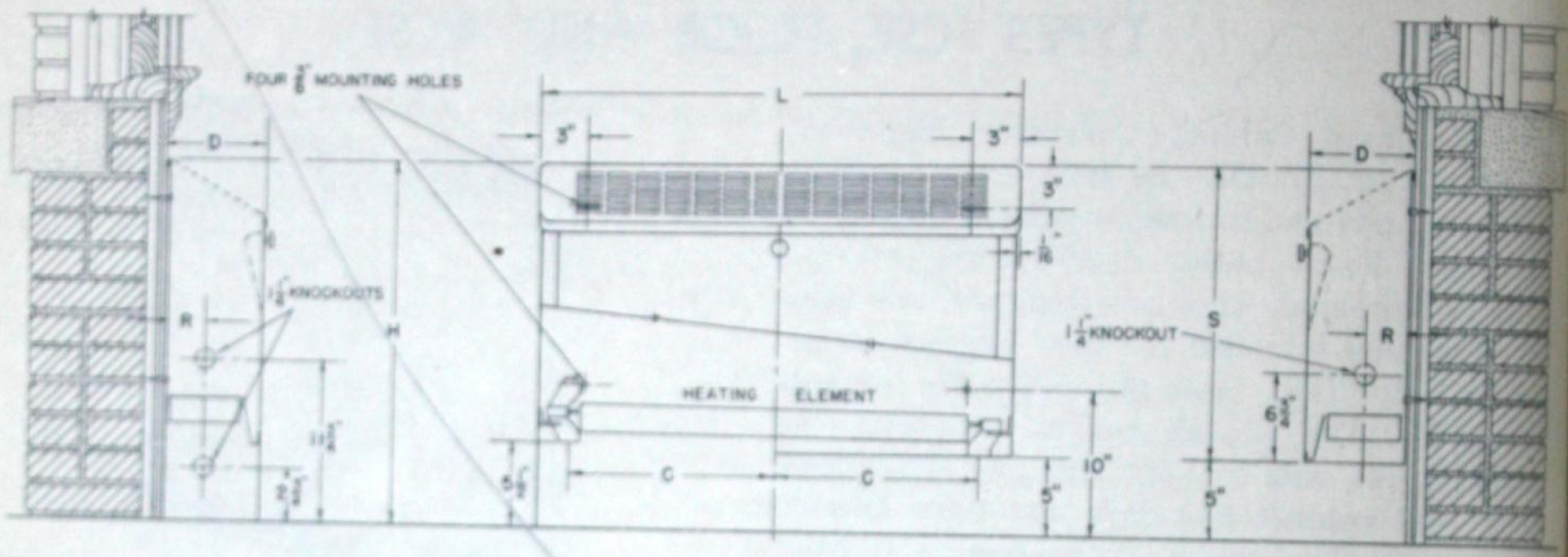
Cabinets are fabricated of sheet steel of quality and gauge which produce a product with all the physical characteristics of fine metal furniture. No bolts, screws or rivets mar the smooth exterior surfaces. Columnar forming of the sides, rounded corners and interior reinforcements produce an exceptionally rugged and rigid assembly. Cabinets are equipped with suitable supports for the heating elements to simplify installation. Dampers, when ordered, are built as an integral part of the removable front panel.



Type FCSOE Floor Cabinet with front removed

DIMENSIONS AND INSTALLATION DATA

TYPES FCSE, FCSOE AND WCSE



Types FCSE-FCSOE

Fig. 3195

Type WCSE

LENGTH													
Ordering Length Reference		14	18	22	26	30	36	42	48	54	60	66	72
"L"	Overall Length	14⅛"	18⅛"	22⅛"	26⅛"	30⅛"	36⅛"	42⅛"	48⅛"	54⅛"	60⅛"	66⅛"	72⅛"
"C"	Tapping Centres	5"	7"	9"	11"	13"	16"	19"	22"	25"	28"	31"	34"

All Tappings ¾".

DEPTH					
Ordering Depth Reference		3E	5E	7E	10E
"D"	Cabinet Depth	4½"	6¼"	8"	11½"
"R"	Tapping Centre	2"	2⅞"	3¾"	5½"

HEIGHT					
"H"	Ordering & Actual Height Types FCSE and FCSOE	20"	23"	26"	32"
"S"	Ordering & Actual Height Type WCSE	15"	18"	21"	27"

HEATING ELEMENT

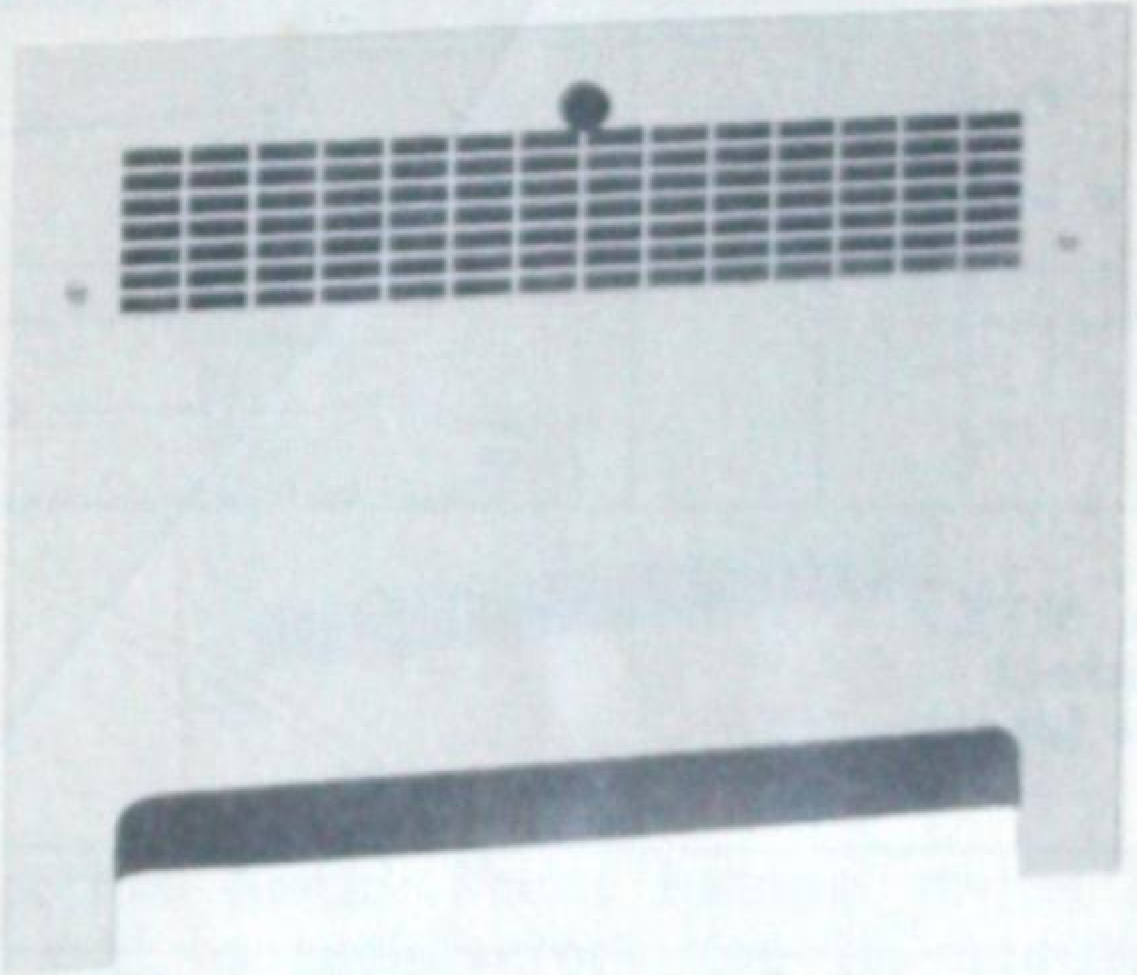
The Dunham Convector uses an all-non-ferrous-alloy heating element. It is uniquely resistant to corrosion and its smooth surfaces do not encourage dust adhesion. Fins are assembled on copper tubes which are welded into bronze supply and return headers. Supply headers are tapped top and bottom, return headers bottom only. Galvanized steel strips along each side protect fins from damage during shipment and installation.

DUNHAM METAL FRONT CONVECTOR RADIATORS

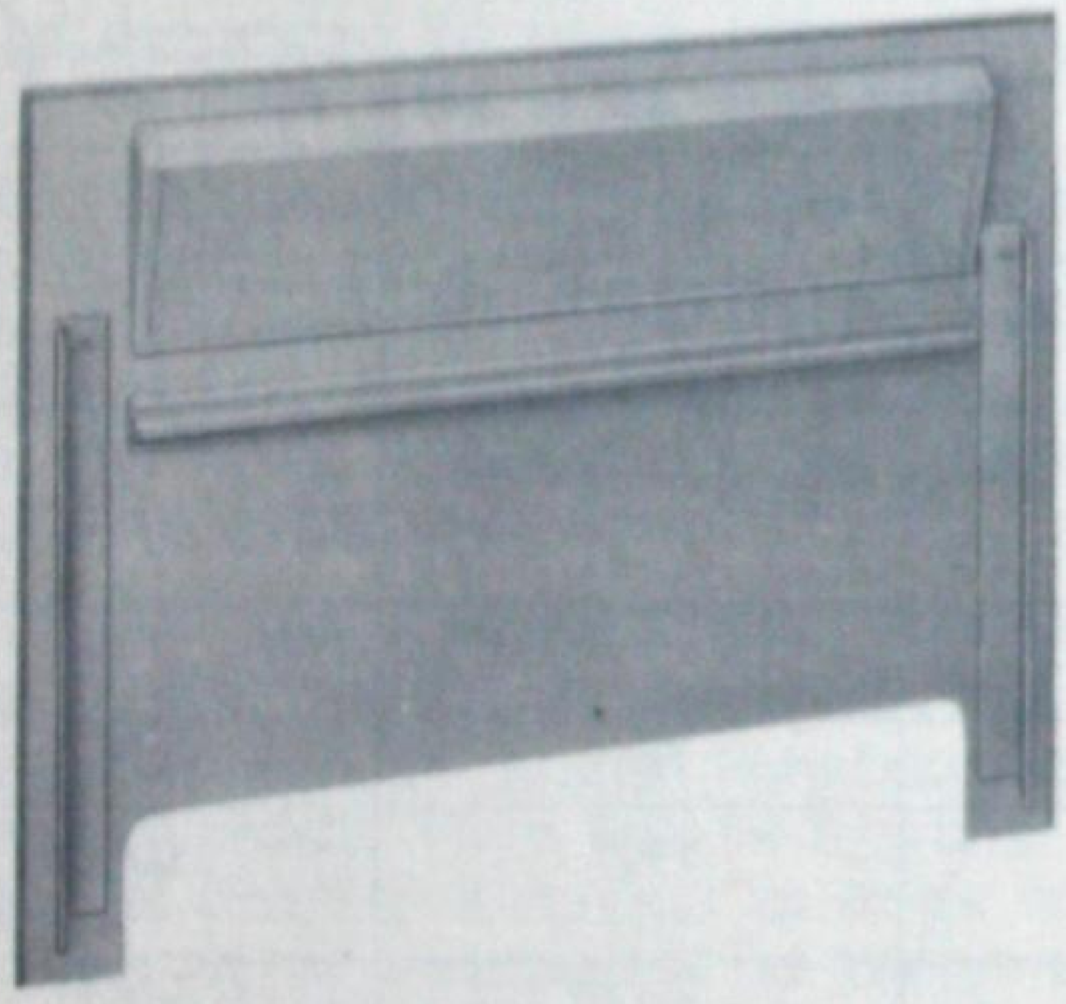
TYPE MFE —Metal Front with Outlet Grille only

TYPE MFRE—Metal Front, Outlet Grille only and Metal Recess Liner

T e Dunham Metal Front Convector Radiators a complete heating units including heating e ments, metal front panels and support angles. C tlet dampers and metal recess liners are s plied when so ordered. The enclosures are d igned for fully recessed Convector applicat n. The Metal Fronts may be made incons cuous by painting to blend in with decoration o wall surfaces, or they may be decorated to h rmonize with woodwork trim. Complete rec sing allows full freedom in the arrangement o furniture and the treatment of floor coveri s and drapes.



Type MFE Front



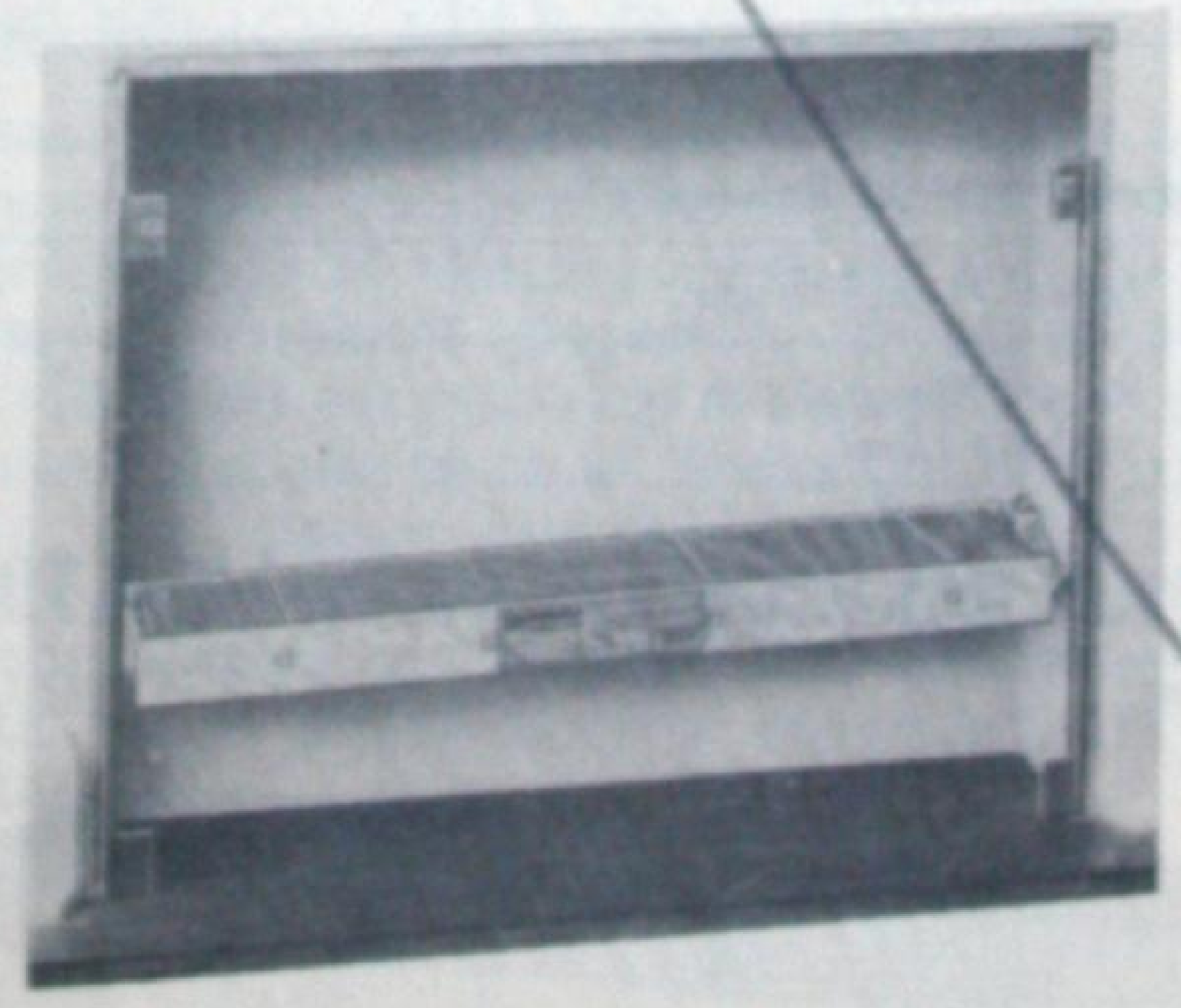
Rear View of Metal Front

A PLICATIONS

T pe MFE Metal Front Panels may be used w erever the thickness and available area of w ls are sufficient to permit installation of the r uired lengths and depths of heating units. O erall recess depths should allow for weatherp ofing, where required, and for insulation o the back of the recess. The installation of m al recess liners is optional. Metal liner exte ds 3/8" below finished flooring. Wood framing o plaster grounds for top and sides of recess a necessary. The support angles for metal f nts are to be applied to the recess jambs by s ews. Metal fronts extend 1 1/8" beyond recess o ning at top and sides. Recesses for 7E and 1 Type MFE Convectors require a baffle a oss the back of the top as indicated in dim sional drawings.

CONSTRUCTION

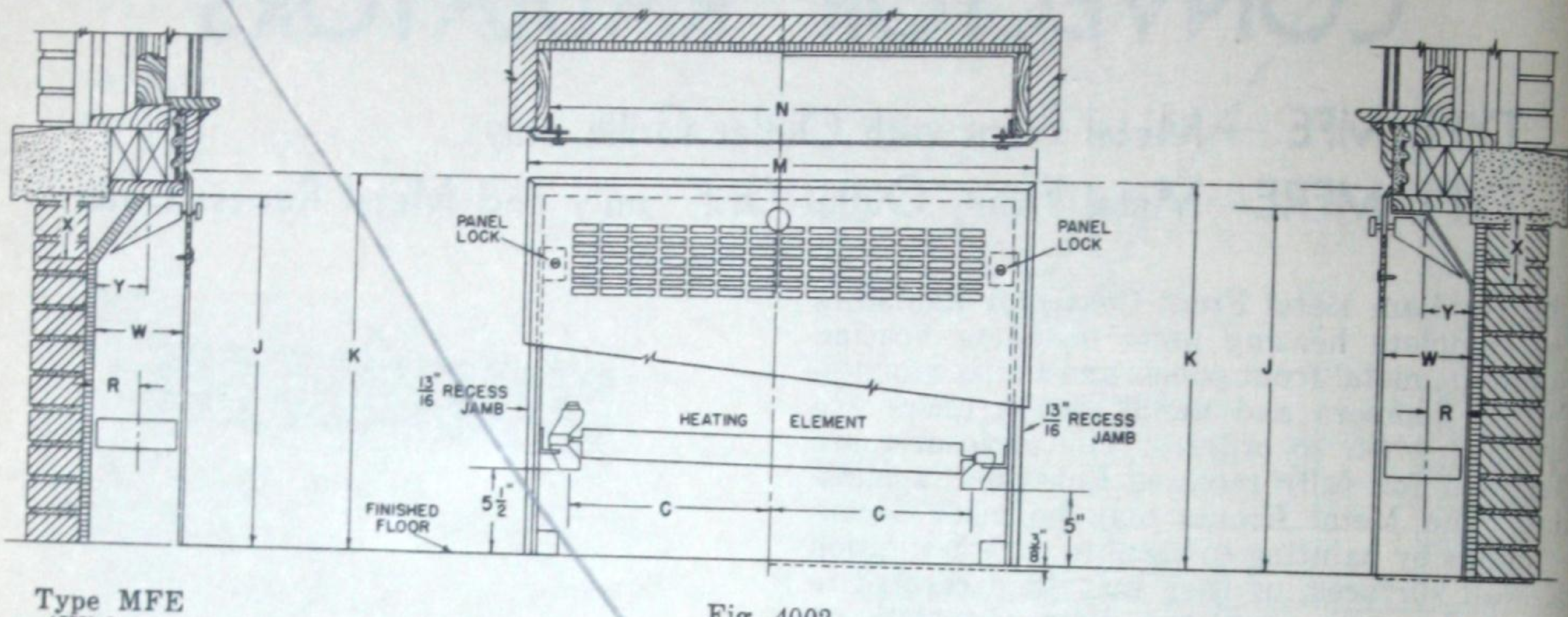
Standard Fronts are fabricated of reinforced sheet metal steel with die-stamped grilles. Metal fronts are available for lengths of heating units and enclosure heights as shown on capacity and dimension tables. Suitable supports for the heating element are supplied to be attached to recess jambs at proper levels. Metal front panels have stiffening bevels at top and sides which provide close fit to finished wall surfaces. Dampers which provide a convenient means to adjust heat output are available when so ordered.



Recess showing support angles for Metal Front

DIMENSIONS AND INSTALLATION DATA

TYPES MFE AND MFRE



Type MFE (Without Recess Liner)

Fig. 4002

Type MFRE (With Recess Liner)

LENGTH													
Ordering Length Reference		14	18	22	26	30	36	42	48	54	60	66	72
"M"	Metal Front Length	16¼"	20¼"	24¼"	28¼"	32¼"	38¼"	44¼"	50¼"	56¼"	62¼"	68¼"	74¼"
"N"	Recess Length with or without Liner	14⅛"	18⅛"	22⅛"	26⅛"	30⅛"	36⅛"	42⅛"	48⅛"	54⅛"	60⅛"	66⅛"	72⅛"
"C"	Tapping Centres	5"	7"	9"	11"	13"	16"	19"	22"	25"	28"	31"	34"
All Tappings ¾".													

DEPTH					
Ordering Depth Reference		3E	5E	7E	10E
"W"	Recess Depth with or without Liner	3⅞"	5⅝"	7⅜"	10⅞"
"R"	Tapping Centre	1$\frac{15}{16}$"	2$\frac{13}{16}$"	3$\frac{11}{16}$"	5$\frac{7}{16}$"
"X"	Baffle Height	—	—	5¼"	9"
"Y"	Baffle Depth	—	—	4⅞"	8⅜"

HEIGHT					
Ordering Height Reference		20"	23"	26"	32"
"K"	Metal Front Height	21¼"	24¼"	27¼"	33¼"
"J"	Recess Height with or without Liner	20⅛"	23⅛"	26⅛"	32⅛"

We reserve the right to change, without notice, dimensions and specifications which will be verified on request.

HEATING ELEMENT

The Dunham Convector uses an all-non-ferrous-alloy heating element. It is uniquely resistant to corrosion and its smooth surfaces do not encourage dust adhesion. Fins are assembled on copper tubes which are welded into bronze supply and return headers. Supply headers are tapped top and bottom, return headers bottom only. Galvanized steel strips along each side protect fins from damage during shipment and installation.

DUNHAM PROJECTION FRONT CONVECTOR RADIATORS

TYPE PMFE — Projection Metal Front with Outlet Grille only
TYPE PMFRE—Projection Metal Front, Outlet Grille only and Metal Recess Liner

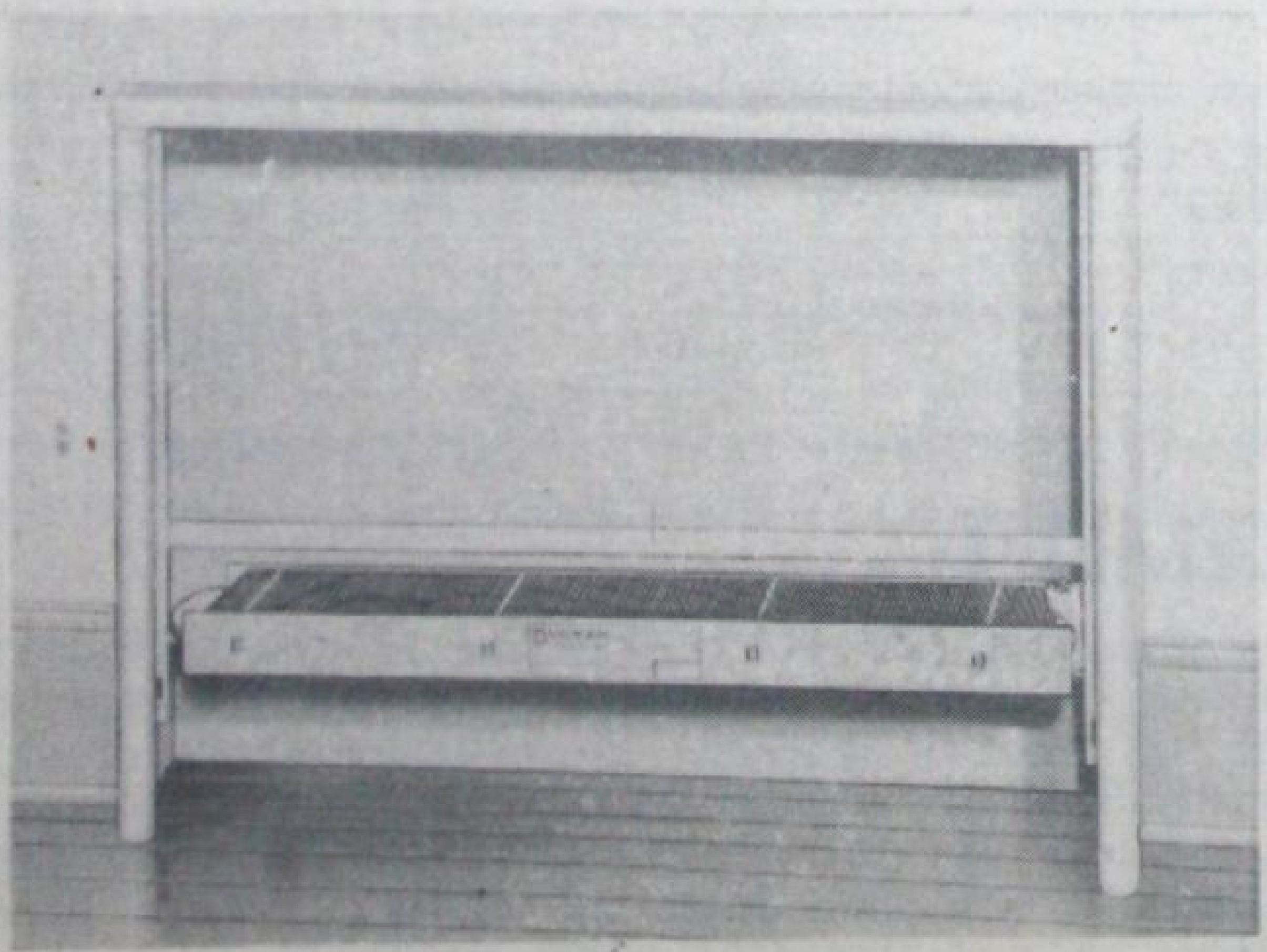
he Dunham Projection Metal Front enclosures rovide for the partial recessing of the heating ement. The portion of the heating element nd enclosure projecting beyond the face of the all is enclosed by the metal front extending yond the limits of side jambs and head of cess, thereby eliminating the necessity of any rrounding moulding. They are made in two rojection dimensions of 2¾″ and 4¼″.

PPLICATION

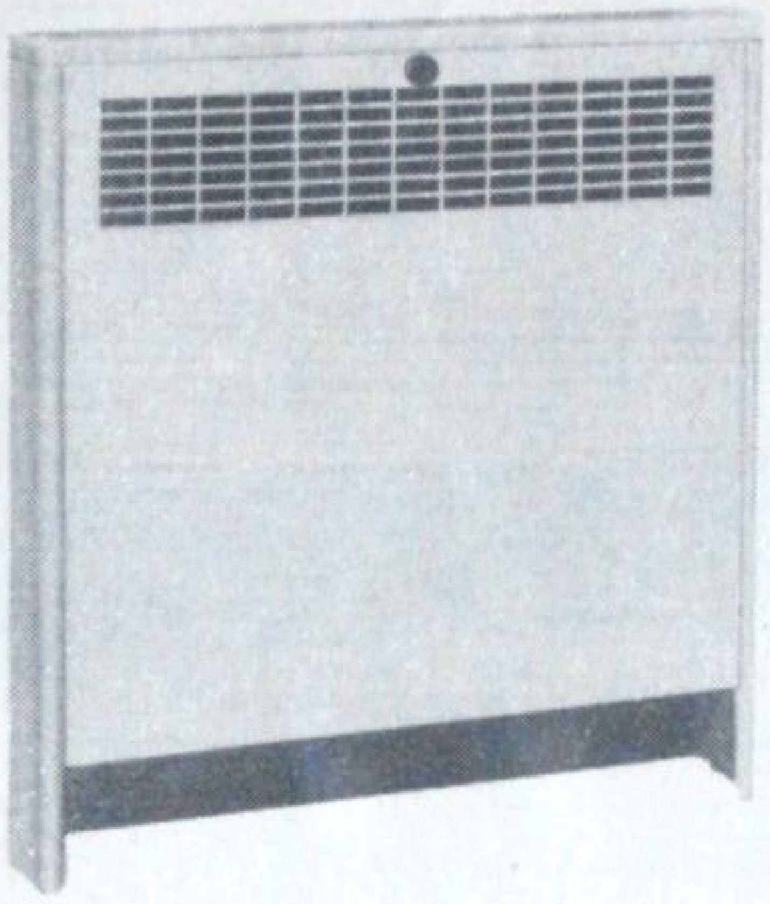
rojection Metal Fronts are applicable to both rame and masonry construction and are per- anently attached to the side jambs of recess inconspicuously located wood screws. They ay be decorated to blend into wall surfaces to harmonize with woodwork trim.

he installation of metal recess liners is op- onal. Metal liner extends ⅜″ below finished ooring. Recesses for Type PMFE Convectors r 7E and 10E Heating Units require a baffle cross the back of the top as indicated in mensional drawings.

ype PMFE Metal Front Panels, having a pro- ection of 2¾″, may be used with 3E and 5E eating elements in frame construction using ominal 4″ studs. They will be suitable for 3E, E and 7E heating elements in brick construc- on where it is permissible to recess into the all to the width of one brick with furring, th and plaster; also for 7E heating elements frame construction using studs of 6″ nominal idth.



Type PMFRE with front removed



Type PMFE Front

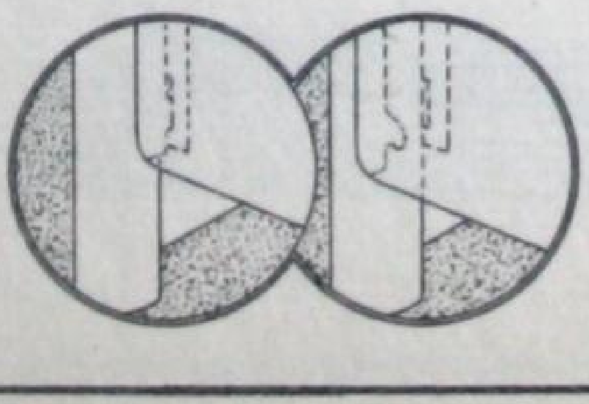
Projection Metal Front having projection of 4¼″ will be satisfactory for 7E heating elements in frame construction using 4″ nominal studs. and for 10E heating elements when used in brick walls where furring can be arranged to suit.

CONSTRUCTION

The Type PMFE enclosures are fabricated of steel of quality and gauge making a product with all the physical characteristics of fine metal furniture. Columnar forming of the sides, rounded corners and internal reinforcements produce an exceptionally rugged and rigid assembly. Suitable metal supports are provided for installation in the recess to support the heating element. Dampers when ordered are built as an integral part of the removable front.

THE REMOVABLE FRONT

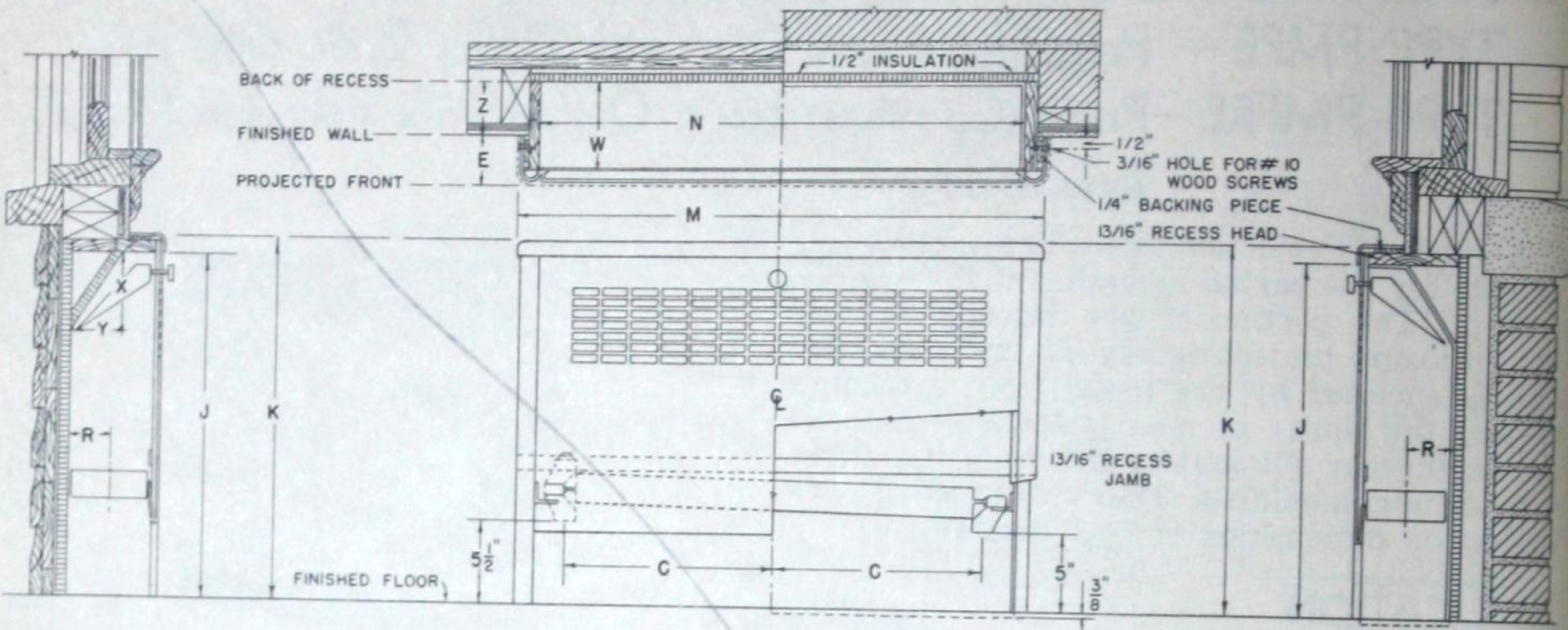
Accessibility is a particularly desirable feature in convectors to simplify installation and periodic cleaning of heating elements and enclosure interior. Dunham projection front enclosures provide this accessibility without the need to remove the entire front enclosure. The removable front panels are easily taken out by upward and outward and downward movement of the bottom of the panel and can be replaced with equal simplicity by reversing the procedure.



FRONT PANEL CATCH
Fig. 3109
Facilitates ready removal and replacement of the front panel of Cabinet Convectors

DIMENSIONS AND INSTALLATION DATA

TYPES PMFE AND PMFRE



Type PMFE
(Without
Recess Liner)

Fig. 3121A

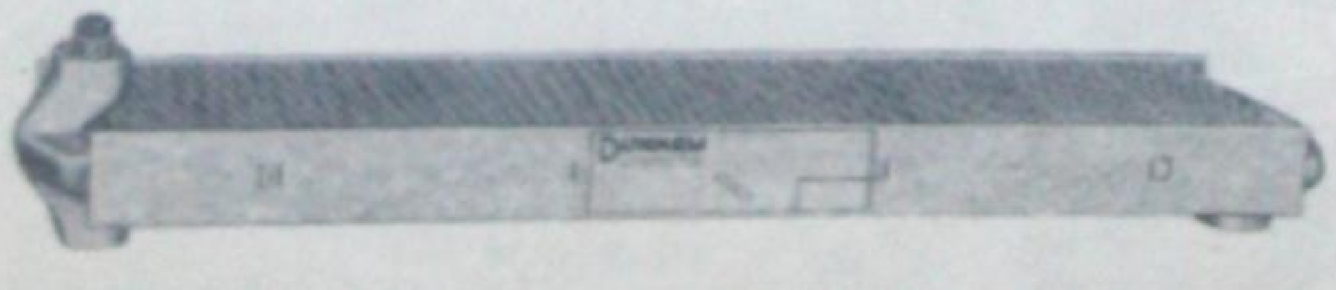
Type PMFRE
(With
Recess Liner)

LENGTH													
Ordering Length Reference		14	18	22	26	30	36	42	48	54	60	66	72
"M"	Projection Front Length	16½"	20½"	24½"	28½"	32½"	38½"	44½"	50½"	56½"	62½"	68½"	74½"
"N"	Recess Length with or without Liner	14⅛"	18⅛"	22⅛"	26⅛"	30⅛"	36⅛"	42⅛"	48⅛"	54⅛"	60⅛"	66⅛"	72⅛"
"C"	Tapping Centres	5"	7"	9"	11"	13"	16"	19"	22"	25"	28"	31"	34"

DEPTH						
Ordering Depth Reference		3E	5E	7E		10E
		All Types Construction	All Types Construction	Masonry and 6" Frame Construction	Masonry and 4" Frame Construction	Masonry Construction with Furring to Suit
"E"	Front Projection	2¾"	2¾"	2¾"	4¼"	4¼"
"Z"	Recess Depth—Face Finished Wall to Back of Recess with or without Liner	111/16"	3 7/16"	5 3/16"	3 11/16"	7 3/16"
"R"	Tapping Centre	1 15/16"	2 13/16"	3 11/16"		5 7/16
"W"	Recess Depth with or without Liner	3⅞"	5⅝"	7⅜"		10⅞"
"X"	Baffle Height	—	—	5¼"		9"
"Y"	Baffle Depth	—	—	4⅞"		8⅜"

HEIGHT					
Ordering Height Reference		20"	23"	26"	32"
"K"	Projection Front Height	21¼"	24¼"	27¼"	33¼"
"J"	Recess Height with or without Liner	20⅛"	23⅛"	26⅛"	32⅛"

HEATING ELEMENT



The Dunham Convector uses an all-non-ferrous-alloy heating element. It is uniquely resistant to corrosion and its smooth surfaces do not encourage dust adhesion. Fins are assembled on copper tubes which are welded into bronze supply and return headers. Supply headers are tapped top and bottom, return headers bottom only. Galvanized steel strips along each side protect fins from damage during shipment and installation.

CONVECTOR ELEMENTS AND GRILLES

HEATING ELEMENT

he Dunham Convector uses an all non-ferrous-
loy heating element. It is uniquely resistant
corrosion and its smooth surfaces do not
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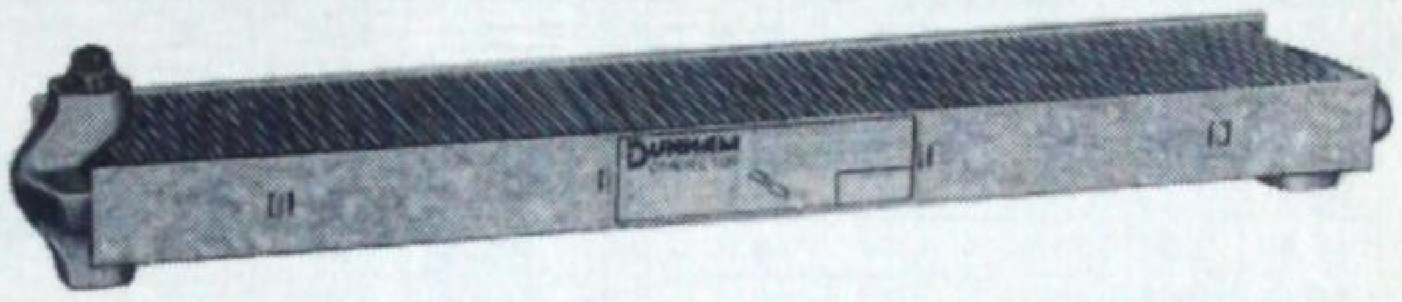


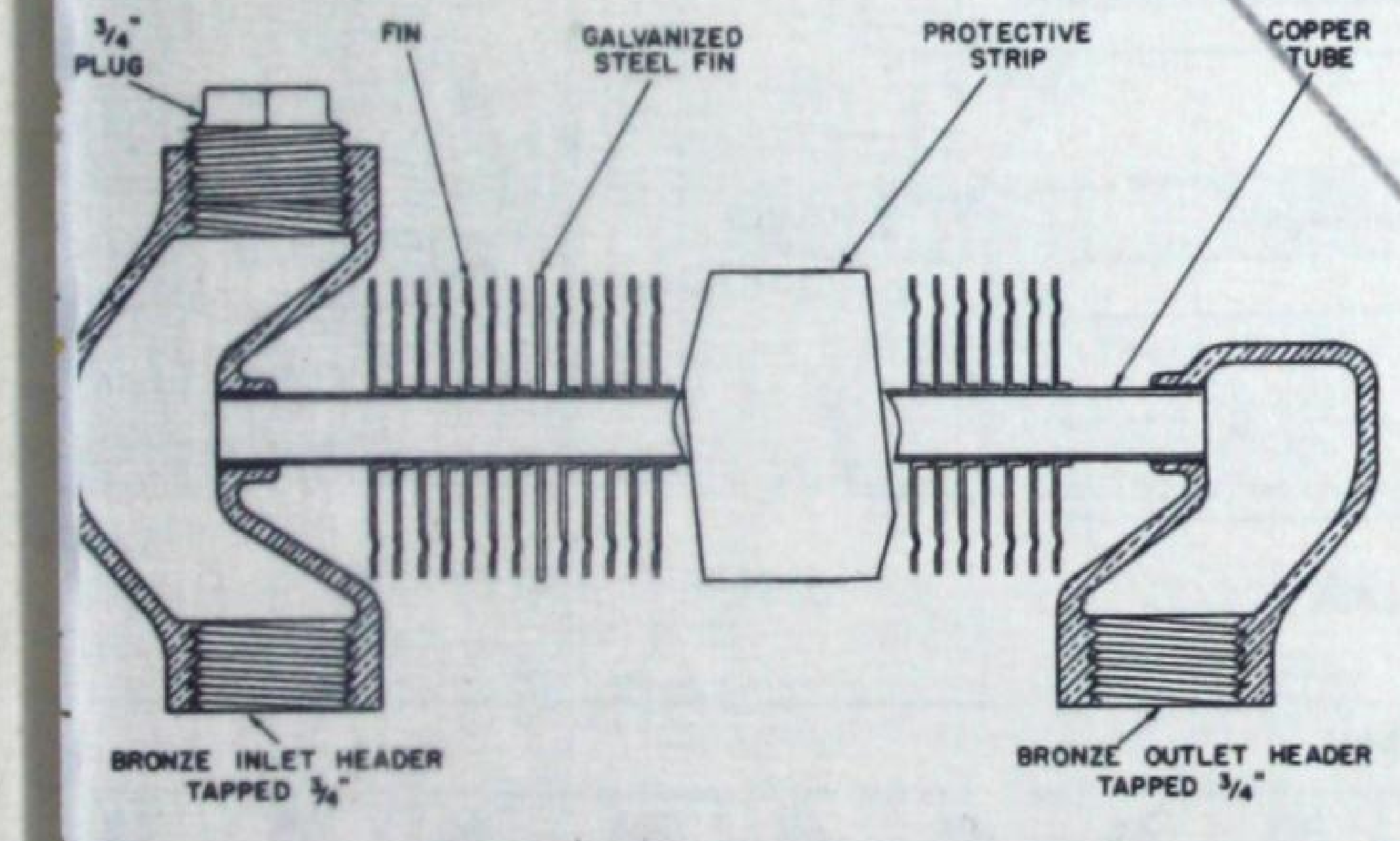

3/4" PLUG
FIN
GALVANIZED STEEL FIN
PROTECTIVE STRIP
COPPER TUBE
BRONZE INLET HEADER TAPPED 3/4"
BRONZE OUTLET HEADER TAPPED 3/4"

Fig. 3044B—Convector element section

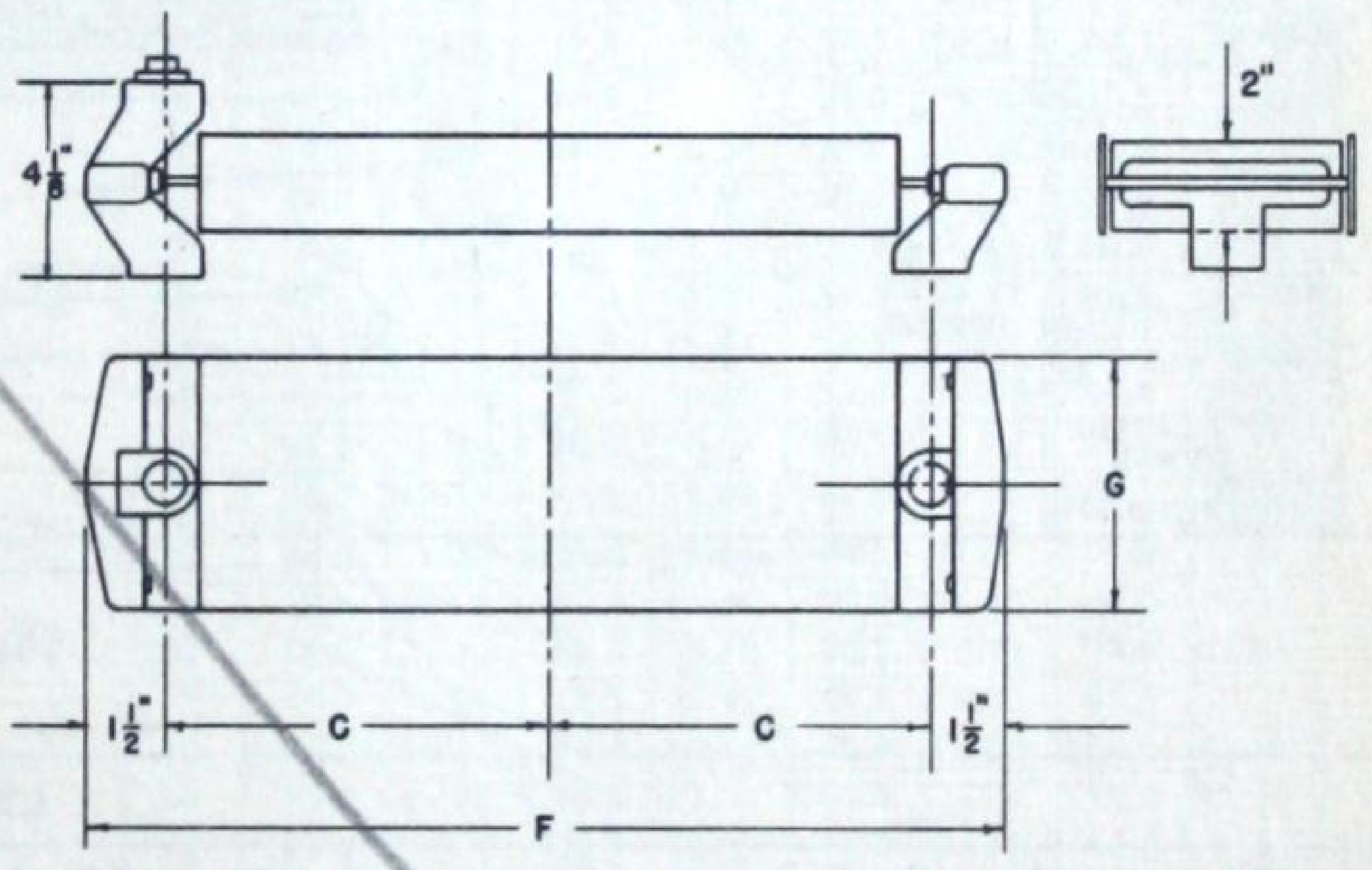


Fig. 3045B

LENGTH

	Ordering Length Reference	14	18	22	26	30	36	42	48	54	60	66	72
'F"	Element Length	13"	17"	21"	25"	29"	35"	41"	47"	53"	59"	65"	71"
'C"	Tapping Centres	5"	7"	9"	11"	13"	16"	19"	22"	25"	28"	31"	34"

DEPTH

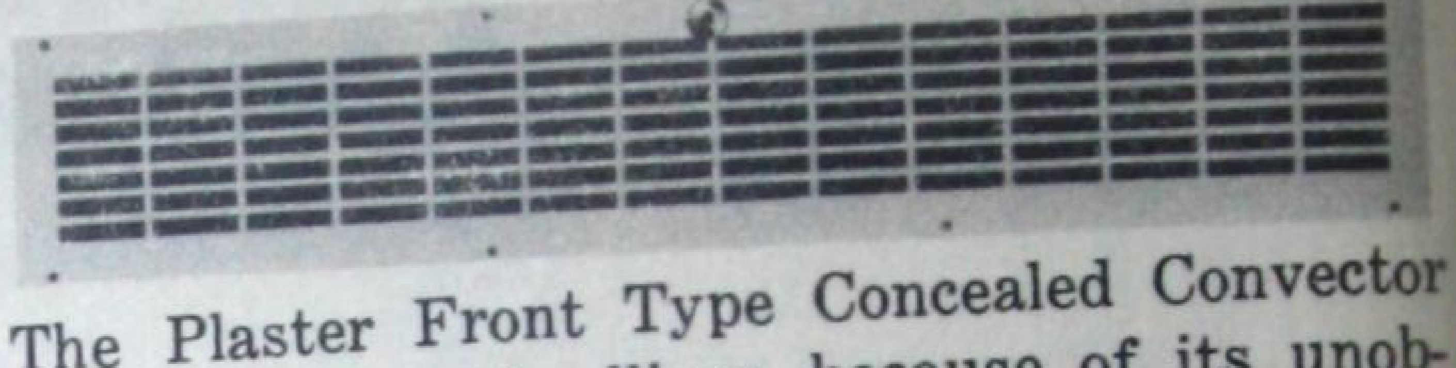
	Ordering Depth Reference	3E	5E	7E	10E
'G"	Element Depth	3 5/8"	5 3/8"	7 1/8"	10 5/8"

GRILLES

FOR FRONT OUTLET CONVECTORS

The simple effective lines of this rectangular design adapt it well to any architectural scheme. The design is perforated in sheet steel. The blank margin frames the one piece unit. The grille is lined on the back with felt to prevent air leakage and wall discoloration.

All grilles and dampers are furnished standard with a prime coat of paint. Screws are not supplied. While dampers are optional they are strongly recommended (even where radiator valves are used), as a convenient method of adjusting the heat output.



The Plaster Front Type Concealed Convector is selected for dwellings because of its unobtrusiveness. The enclosure for the heating element is provided for in the building construction and the metal outlet grille is arranged for installation on plaster face as shown on Fig. 3118A. The inlet can be made through an opening cut in the baseboard to dimensions indicated in Fig. 3118A.

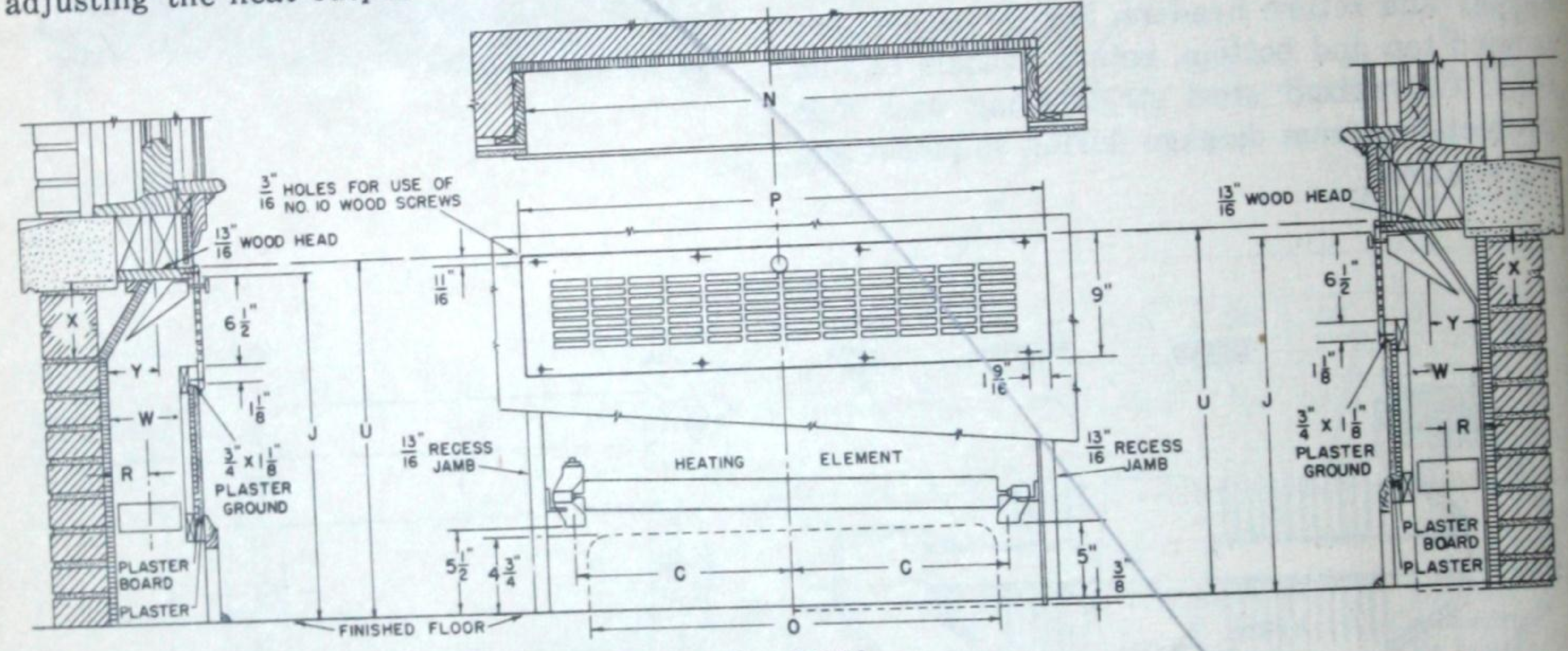


Fig. 3118A

LENGTH												
Ordering Length Reference	14	18	22	26	30	36	42	48	54	60	66	72
"P" Grille Length	18″	22″	26″	30″	34″	40″	46″	52″	58″	64″	70″	76″
"N" Recess Length with or without Liner	14⅛″	18⅛″	22⅛″	26⅛″	30⅛″	36⅛″	42⅛″	48⅛″	54⅛″	60⅛″	66⅛″	72⅛″
"O" Inlet Opening Length	9″	13″	17″	21″	25″	31″	37″	43″	49″	55″	61″	67″
"C" Tapping Centres	5″	7″	9″	11″	13″	16″	19″	22″	25″	28″	31″	34″

DEPTH				
Ordering Depth Reference	3E	5E	7E	10E
"W" Recess Depth with or without Liner	3⅞″	5⅝″	7⅜″	10⅞″
"R" Tapping Centre	1 15/16″	2 13/16″	3 11/16″	5 7/16″
"X" Baffle Height	—	—	5¼″	9″
"Y" Baffle Depth	—	—	4⅞″	8⅜″

HEIGHT				
Ordering Height Reference	20″	23″	26″	32″
"U" Grille Height	21 7/32″	24 7/32″	27 7/32″	33 7/32″
"J" Recess Height with or without Liner	20⅛″	23⅛″	26⅛″	32⅛″

DUNHAM CONVECTOR RADIATORS

CAPACITIES - IN EDR and Mbh STEAM SYSTEMS

Dunham Convectors will function satisfactorily on either steam or hot water heating systems. Capacities have been determined by tests and can be used with confidence that they will deliver the heat output indicated in capacity tables with the heating medium maintained at the average temperature for which the heating system is designed and when the system is properly installed and vented.

Convectors should be designated on plans and orders by "depth symbol" x "ordering length" x "ordering height" and the sq. ft. EDR as 5E x 30 x 26 = 30.5 sq. ft. for all floor cabinets or recessed units and 5E x 30 x 21 = 30.5 sq. ft. for wall cabinets only.

Note: *Overall height (ordering height), of wall cabinets is 5" less than floor cabinets.*

SELECTION OF CONVECTORS B.T.U. METHOD—STEAM SYSTEMS

The capacity Table No. 1 shows convector capacities in square feet equivalent direct radiation (EDR) and thousands B.T.U. per hour (Mbh). To determine size of convector for a Steam Heating System by B.T.U. method, first estimate total B.T.U. required. If operating steam pressure equals 1 lb. with a steam temperature of 215°F, choose convector from Table No. 1 having Mbh rating equal to or nearest to that estimated and to suit limitation of space dimensions.

Example (1):
Estimated BTU per hour 12,000.
This would be provided by either a
one—5E x 48 x 26" Convector, Capacity 12.12 Mbh
or one—7E x 42 x 23" Convector, Capacity 12.72 Mbh
for floor cabinets or recessed units.

If operating steam pressures are other than 1 lb., then multiply estimated B.T.U. per hour by Selection Factor in Col. No. 4, Table No. 2, for pressure used.

Example (2):
Estimated BTU 12,000. Steam press. 5 lbs., Selection Factor .90, then 12,000 x .90 = 10,800. Select
one—5E x 48 x 23" Convector, Capacity 11.40 Mbh
or one—7E x 36 x 23" Convector, Capacity 10.68 Mbh.

Note: *Convector capacity for other than standard conditions may be determined by multiplying B.T.U. listed in Table No. 1 by factor in Col. No. 5, Table No. 2.*

SQ. FT. EDR METHOD—STEAM SYSTEMS

When heat loss is computed by EDR method and assuming 240 BTU per hour per EDR for steam systems operating with steam at 215°F, convector radiator capacity can be read direct from Table No. 1.

Example (3):
Estimated EDR 50 sq. ft.
Steam temperature 215°F.
From Capacity Table No. 1, select
one—5E x 48 x 26" = 50.5 sq. ft.
or one—7E x 42 x 23" = 53.0 sq. ft.

Where steam pressure is other than 1 lb. and 215°F, estimated EDR (at 240 BTU) is to be multiplied by Selection Factor in Col. No. 4, Table No. 2, to determine convector radiator size.

Example (4):
Estimated EDR 50 sq. ft.
Steam pressure 10 lbs., temperature 240°F, Selection Factor .80, then 50 x .80 = 40.
From Capacity Table No. 1, select
one—5E x 42 x 23" = 41 sq. ft.
or one—7E x 30 x 26" = 39 sq. ft.

Table No 1

Ordering Depth Symbol	Ordering Length	Capacities in Sq. Ft. EDR and Mbh—Based on Steam at 215° F. and Entering Air Temp. 65° F.							
		Ordering Heights in Inches Floor Cabinets and Recessed Units							
		20		23		26		32	
		Ordering Heights in Inches Wall Cabinets							
		15		18		21		27	
		EDR*	Mbh†	EDR*	Mbh†	EDR*	Mbh†	EDR*	Mbh†
3E	14	8.0	1.92	8.5	2.04	8.5	2.04	9.0	2.16
	18	10.5	2.52	11.5	2.76	12.0	2.88	12.5	3.00
	22	13.5	3.24	14.5	3.48	15.0	3.60	16.0	3.84
	26	16.0	3.84	17.0	4.08	18.0	4.32	19.0	4.56
	30	19.0	4.56	20.0	4.80	21.0	5.04	22.5	5.40
	36	23.0	5.52	24.5	5.88	26.0	6.24	27.5	6.60
5E	14	11.0	2.62	12.0	2.88	12.5	3.00	13.5	3.24
	18	14.5	3.48	16.0	3.84	17.0	4.08	18.5	4.44
	22	18.5	4.44	20.5	4.92	21.5	5.16	23.0	5.52
	26	22.5	5.40	24.5	5.88	26.0	6.24	28.0	6.72
	30	26.0	6.24	28.5	6.84	30.5	7.32	33.0	7.92
	36	32.0	7.68	35.0	8.40	37.0	8.86	40.0	9.60
	42	37.5	9.00	41.0	9.84	43.5	10.43	47.5	11.40
	48	43.5	10.44	47.5	11.40	50.5	12.12	54.5	13.08
	54	49.0	11.76	54.0	12.96	57.0	13.68	62.0	14.88
	60	55.0	13.20	60.0	14.40	63.5	15.24	69.5	16.68
	66	61.0	14.64	66.5	15.96	70.0	16.80	77.0	18.48
	72	67.0	16.08	72.5	17.40	76.5	18.36	84.5	20.28
7E	26	27.5	6.60	31.0	7.44	33.0	7.92	35.5	8.52
	30	33.0	7.92	36.5	8.76	39.0	9.36	42.5	10.20
	36	40.0	9.60	44.5	10.68	48.0	11.52	51.5	12.36
	42	48.0	11.52	53.0	12.72	56.0	13.44	60.5	14.52
	48	55.5	13.32	61.0	14.64	64.5	15.48	69.0	16.56
	54	63.5	15.24	69.5	16.68	73.5	17.64	78.5	18.84
	60	71.0	17.04	77.5	18.60	82.0	19.68	88.0	21.12
	66	78.5	18.84	86.0	20.64	90.5	21.72	97.5	23.40
	72	86.0	20.64	94.5	22.68	99.0	23.76	106.5	25.56
10E	30	41.5	9.96	46.0	11.04	48.5	11.64	55.0	13.20
	36	50.5	12.12	55.5	13.32	60.0	14.40	67.0	16.08
	42	60.0	14.40	65.5	15.72	70.5	16.92	78.5	18.84
	48	69.0	16.56	75.5	18.12	81.5	19.56	91.5	21.96
	54	77.5	18.60	85.5	20.52	92.0	22.08	104.0	24.96
	60	87.0	20.88	96.0	23.04	103.5	24.84	115.0	27.60
	66	98.0	23.52	107.5	25.80	115.0	27.60	126.0	30.24
	72	110.0	26.40	118.5	28.44	126.0	30.24	137.0	32.88

† Mbh Thousands BTU per hour.

* One EDR equals 240 BTU per hour.

Table No. 2

Capacities and Corrections Factors for Various Steam Pressures and Temperatures Applying to Table No. 1 — STEAM HEATING SYSTEMS				
Steam Pressure Lbs. per Sq. Inch	Steam Temperature ° F.	BTU Output per EDR	Correction Factors	
			Selection Factor	Output Factor
Col. No. 1	Col. No. 2	Col. No. 3	Col. No. 4	Col. No. 5
1	215	240	1.00	1.00
5	227	267	.90	1.112
10	240	300	.80	1.125
15	250	320	.75	1.330
20	259	343	.70	1.430
25	267	364	.66	1.517

Note: To determine output of Convectors for conditions other than stated in Table No. 1, multiply EDR or Mbh values in Table No. 1 by Output Factors in Col. No. 5, Table No. 2.

CAPACITIES - IN EDR and Mbh
HOT WATER SYSTEMS

SELECTION OF CONVECTORS B.T.U. METHOD—HOT WATER SYSTEMS

Convector Radiators are to be selected from Capacity Table No. 3.

To determine size of convector for Mechanically Circulated Hot Water Heating System, first estimate B.T.U. per hour required, determine average temperature of water to be circulated through convector, multiply estimated B.T.U. per hour by Selection Factor in Col. No. 8, Table No. 4, and select from Table No. 3 convector radiator equal to or nearest to corrected B.T.U. value.

Example (5):
Estimated BTU 12,000.
Average water temperature 180°F, correction factor 1.13,
then 12,000 x 1.13 = 13,560. Select from Table No. 3,
one—7E x 66 x 26″ = 13.85 Mbh
or one—7E x 60 x 32″ = 13.46 Mbh.

To determine size of convector for Gravity Circulated Hot Water System, estimate B.T.U. per hour required and multiply B.T.U. by Selection Factor in Col. No. 11, Table No. 4, for average water temperature to be circulated through convector and select from Table No. 3 convector radiator equal to or nearest to corrected B.T.U. value.

Example (6):
Estimated BTU per hour 12,000.
Water temperature 170°F, factor 1.40,
then 12,000 x 1.40 = 16,800. Select
one— 7E x 72 x 32″ = 16.30 Mbh
or one—10E x 66 x 23″ = 16.45 Mbh.

SELECTION OF CONVECTORS SQ. FT. EDR METHOD—HOT WATER SYSTEMS

Example (7)—(Mechanical Circulation):
Estimated EDR 50 sq. ft. (150 BTU per EDR per hour)
Average water temperature 190°F.
Read direct from Table No. 3, select
one—5E x 48 x 26″ = 50.5 sq. ft.
or one—7E x 42 x 23″ = 53.0 sq. ft.

Example (8)—(Mechanical Circulation):
Estimated EDR 50 sq. ft.
Average water temperature 220, Selection Factor .72 (Table No. 4, Col. No. 8)
then 50 x .72 = 36, select from Table No 3
one—5E x 36 x 26″ = 37.0 sq. ft.
or one—7E x 30 x 23″ = 36.5 sq. ft.

Example (9)—(Gravity Circulation):
Estimated EDR 50 sq. ft.
Average water temperature 180°F, Selection Factor 1.20, (Col. No. 11, Table No. 4),
then 50 x 1.20 = 60, select from Table No 3
one—5E x 60 x 23″ = 60 sq. ft.
or one—7E x 48 x 23″ = 61 sq. ft.

In the examples cited, floor cabinets or recessed unit heights have been given. Where wall cabinets are desired, the last figures would be 5″ less than shown in examples. For instance, a 5E x 60 x 23″ becomes 5E x 60 x 18″ for wall cabinet units.

To estimate the quantity of water to be circulated through a convector or through a hot water system and to determine circulating pump capacity, allow as follows:

.10 U.S. gallons per minute per 1000 BTU per hour;
1.5 U.S. gallons per minute per 100 sq. ft. EDR based on 150 BTU per sq. ft.

Table No. 3

Capacities in Sq. Ft. EDR and Mbh—Based on Inlet Air 65° F. and 190° F. Average Water Temp. for Mechanically Circulated Systems and 195° F. Average Water Temp. for Gravity Circulated Systems.

Ordering Depth Symbol	Ordering Length	Ordering Heights in Inches Floor Cabinets and Recessed Units							
		20		23		26		32	
		Ordering Heights in Inches Wall Cabinets							
		15		18		21		27	
		EDR*	Mbh†	EDR*	Mbh†	EDR*	Mbh†	EDR*	Mbh†
3E	14	8.0	1.22	8.5	1.30	8.5	1.30	9.0	1.38
	18	10.5	1.61	11.5	1.76	12.0	1.84	12.5	1.91
	22	13.5	2.07	14.5	2.22	15.0	2.30	16.0	2.45
	26	16.0	2.45	17.0	2.60	18.0	2.75	19.0	2.91
	30	19.0	2.91	20.0	3.06	21.0	3.21	22.5	3.44
	36	23.0	3.52	24.5	3.74	26.0	3.98	27.5	4.21
5E	14	11.0	1.68	12.0	1.85	12.5	1.91	13.5	2.07
	18	14.5	2.22	16.0	2.46	17.0	2.60	18.5	2.83
	22	18.5	2.83	20.5	3.14	21.5	3.30	23.0	3.52
	26	22.5	3.44	24.5	3.74	26.0	3.98	28.0	4.28
	30	26.0	3.98	28.5	4.36	30.5	4.66	33.0	5.05
	36	32.0	4.90	35.0	5.36	37.0	5.66	40.0	6.12
	42	37.5	5.74	41.0	6.27	43.5	6.66	47.5	7.27
	48	43.5	6.66	47.5	7.27	50.5	7.73	54.5	8.34
	54	49.0	7.50	54.0	8.26	57.0	8.72	62.0	9.50
	60	55.0	8.42	60.0	9.18	63.5	9.72	69.5	10.64
	66	61.0	9.34	66.5	10.17	70.0	10.71	77.0	11.78
	72	67.0	10.26	72.5	11.09	76.5	11.70	84.5	12.93
7E	26	27.5	4.21	31.0	4.74	33.0	5.05	35.5	5.43
	30	33.0	5.05	36.5	5.58	39.0	5.97	42.5	6.50
	36	40.0	6.12	44.5	6.80	48.0	7.34	51.5	7.88
	42	48.0	7.34	53.0	8.11	56.0	8.56	60.5	9.26
	48	55.5	8.50	61.0	9.33	64.5	9.87	69.0	10.56
	54	63.5	9.72	69.5	10.63	73.5	11.25	78.5	12.00
	60	71.0	10.86	77.5	11.86	82.0	12.55	88.0	13.46
	66	78.5	12.01	86.0	13.16	90.5	13.85	97.5	14.91
	72	86.0	13.16	94.5	14.46	99.0	15.15	106.5	16.30
10E	30	41.5	6.35	46.0	7.04	48.5	7.42	55.0	8.41
	36	50.5	7.72	55.5	8.50	60.0	9.18	67.0	10.25
	42	60.0	9.18	65.5	10.02	70.5	10.78	78.5	12.00
	48	69.0	10.56	75.5	11.55	81.5	12.47	91.5	14.00
	54	77.5	11.86	85.5	13.08	92.0	14.08	104.0	15.91
	60	87.0	13.31	96.0	14.68	103.5	15.83	115.0	17.60
	66	98.0	15.00	107.5	16.45	115.0	17.60	126.0	19.28
	72	110.0	16.83	118.5	18.13	126.0	19.28	137.0	20.96

† Mbh Thousands BTU per hour.

* One EDR equals 153 BTU per hour.

Table No. 4

Capacities and Correction Factors for Various Average Water Temperatures Applying to Table No. 3

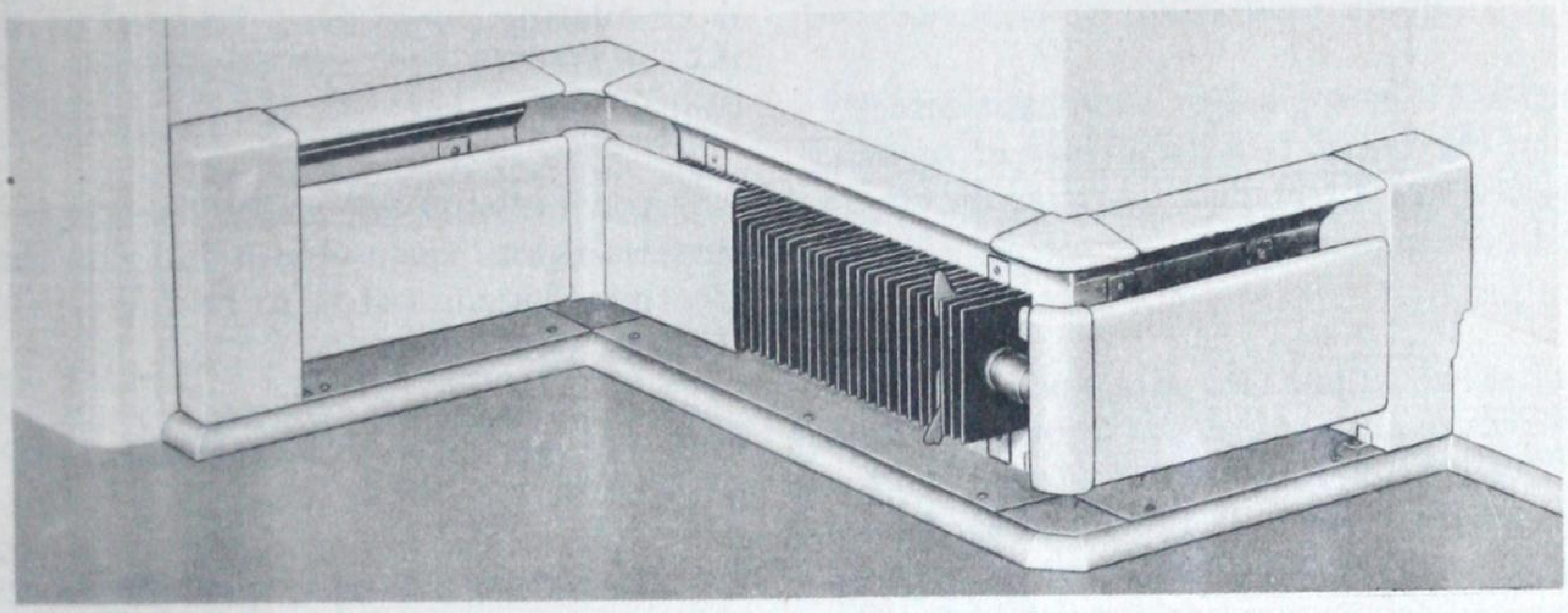
HOT WATER SYSTEMS

Average Water Temp. °F.	Mechanical Circulation			Gravity Circulation		
	BTU Output Per EDR	Correction Factors		BTU Output Per EDR	Correction Factors	
		Selection Factor	Output Factor		Selection Factor	Output Factor
Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
170	120	1.275	.784	110	1.40	.720
175	127	1.20	.830	119	1.28	.780
180	135	1.13	.882	127	1.20	.830
185	144	1.06	.940	136	1.12	.882
190	153	1.00	1.000	142	1.06	.940
195	162	.94	1.060	153	1.00	1.000
200	172	.90	1.124	162	.94	1.124
210	191	.80	1.250	180	.85	1.175
220	212	.72	1.385	199	.77	1.300

Note: To determine output of Convectors for conditions other than stated in Table No. 3, multiply EDR or Mbh values in Table No. 3 by Output Factors in Col. No. 9 or Col. No. 12, Table No. 4.

DUNHAM BASEBOARD CONVECTOR

TYPE BOTCS



unham Baseboard Convector Radiators have een developed for homes and the smaller buildngs, and in keeping with modern trends, proide for the heat to be supplied near the floor f a room—the most efficient location.

he Dunham Baseboard Convector Radiator rovides the following advantages:

- Vider distribution of heat.
- Iore equitable floor to ceiling temperatures nd a mild radiant heat at a desirable location.
- Varmer inside surfaces of floors and exterior valls.
- more comfortable and effective circulation f warmed air throughout the room.
- ase and accessibility for periodic cleaning of eating element.
- ir flow from Baseboard Unit while upward is lso outward from wall surfaces which reduces all discoloration to a minimum.
- eplaces conventional baseboard on walls to hich it is applied.
- ore usable floor area.
- more flexible arrangement of furniture than ossible with other types of radiators.
- armonious blending of radiator with interior ecorations and furnishings.
- educes basement piping to a minimum.

The complete Baseboard Convector Radiator includes heating element, back panel, brackets, front panel and items of trim for abutting to partitions, door frames, etc.

The Dunham Baseboard Convector Radiator Unit has an overall height of 9¼″ and projects 2¼″ from finished plaster surface. A ¾″ x 1″ plaster "ground" must be applied to furring and set with top edge 9″ above finished floor. A ¾″ "step" at the bottom of the enclosure allows for the use of wall-to-wall rugs. The edge of the rug will butt to this "step" and will thereby be flush with the line of the front panel. If wall-to-wall rugs are not used, then a "shoe strip" may be applied to the floor in front of the unit.

The Dunham Baseboard Convector Radiator Element is constructed of 2¾″ x 4″ steel fins on a 1″ copper tube which is expanded to provide a permanent and efficient bond with the fins to ensure efficient heat transmission. The outside diameter of the expanded copper tube is equal to that of standard one inch copper tubing and provides for standard solder type fittings to be used.

The Dunham Baseboard Convector Radiator Elements are available in overall lengths of 24, 36, 48, 60 and 72 inches.

The back panels and front panels are furnished in 5-foot lengths. These are used in multiple for walls longer than 5 feet and may be readily cut with a hacksaw for intermediate lengths.

The front panel is applied to and snaps directly in place on the brackets without use of screws. Splice plates are furnished to cover joints in front and back panels.

Trim units are applied to the ends of Baseboard enclosure sections at partitions and door jambs. These trim units are fastened to the back panel with screws. If the Baseboard Convector is carried around an internal or external corner, special trim units are furnished for the front and back panels.

A simple but effective damper may be installed where occasional lower temperatures are desired in certain rooms. The damper is particularly adaptable to bedrooms where a lower temperature may be required at night.

See installation section for detailed description of application.

A circulating pump must be used to distribute the water through the Baseboard Units and connecting piping.

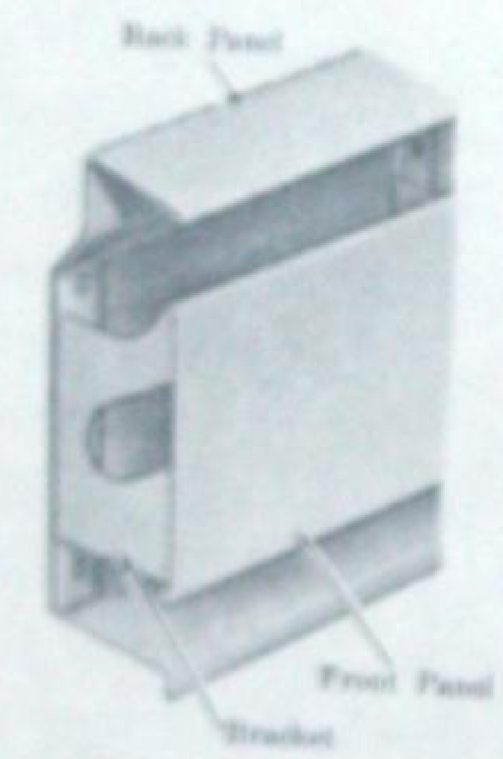
Any conventional hot water heating boiler will be satisfactory for use with Dunham Baseboard Heating System and is to be furnished by the Heating Contractor.

Standard systems of hot water temperature controls can be used.

The connecting piping and all fittings in basement and to Baseboard Units are to be furnished by the Heating Contractor.

DUNHAM BASEBOARD COMPONENTS

Heating Element

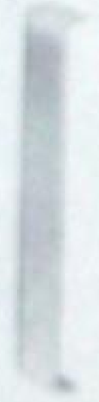


Baseboard Enclosure

Back Panel Splice Plate

Damper

Internal Angle Insert



Front Panel Splice Plate

Front Panel Angle Insert (Universal)

External Angle Insert

Right Hand Door Trim

Left Hand Door Trim

Right Hand Partition Trim

Left Hand Partition Trim

Trim with Access Door

Trim Unit with Access Door may be furnished in Right or Left Hand Door Trim or Partition Trim patterns.

DUNHAM BASEBOARD CONVECTOR HEATING SYSTEM DESIGN DATA

(1) Calculate the heat loss for the space to be heated in accordance with standard practices as published by the American Society of Heating and Ventilating Engineers or other accepted authorities. This heat loss should be determined in B.T.U.'s.

(2) Select initial water temperature. This water temperature will be contingent on the wall space available for installing a sufficient number of Dunham Baseboard Heating Elements to balance the heat loss. 180°F. to 200°F. is common initial water temperature for many localities.

(3) From Table No. 1, select elements of sufficient length to provide the necessary heat output on the basis of the water temperature selected.

Example:
Residence Dining Room.
Heat required = 4065 B.T.U.'s.
Water temperature, design conditions, 190°F.
From Table No. 1, select one 48″ unit and one 36″ unit which supply a total of 4190 B.T.U.'s.

(4) Show on the heating plans the arrangenent of heating elements. These should be laced along outside walls and concentrated nder windows rather than spaced equal disances apart. However, where there is insuficient length of outside wall to accommodate ll the element length required, it will be necesary to use inside partition walls.

5) Determine the position of the various ciruits taking into consideration the heating load nd length of run. Allow a maximum load of 0,000 B.T.U. in any one circuit. When more han one circuit is employed, the heating loads nd piping runs should be made as nearly equal s possible. This facilitates balancing after the ircuits have been installed.

Piping expansion due to water temperature changes requires that straight runs of piping and elements should not exceed 20 feet. If it is necessary to use a straight run longer than 20 feet, provide for expansion by means of a loop at a partition or a loop similar to the type used to under-pass a door.

(6) To compensate for reduced output of elements for an estimated temperature drop of 20°F. within the circuit, re-estimate the length of heating elements in the circuit on the basis of Table No. 2.

Table No. 2

LOAD ON CIRCUIT	PART OF CIRCUIT LOAD	OUTPUT SELECTION BASIS
UP TO 35,000 B.T.U.	First Half of Load	Initial Water Temp.
	Last Half of Load	10° Less than Initial Water Temp.
35,000 B.T.U. TO 50,000 B.T.U.	First Third of Load	Initial Water Temp.
	Second Third of Load	10° Less than Initial Water Temp.
	Last Third of Load	20° Less than Initial Water Temp.

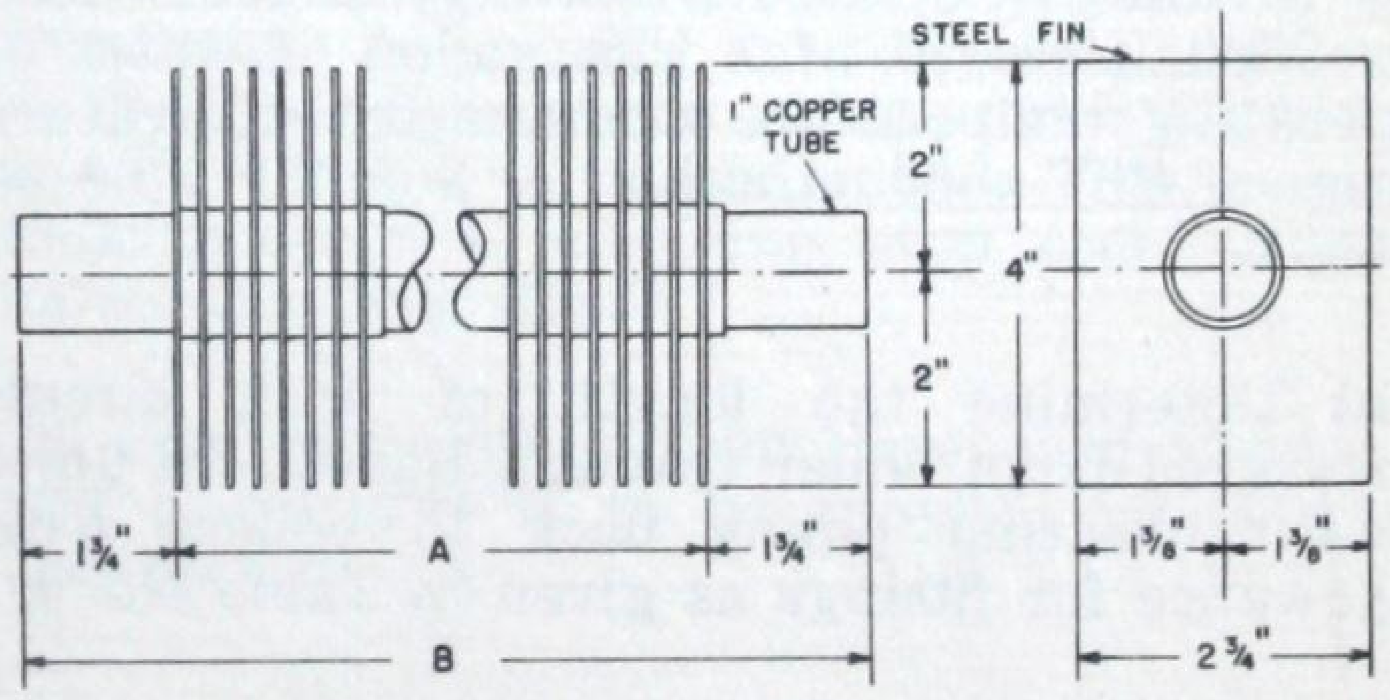


Fig. 3184A—Heating Element

able No. 1

CAPACITY DATA DUNHAM BASEBOARD CONVECTORS

ELEMENT NUMBER	LENGTH IN INCHES		B.T.U. PER HOUR AT 65° F ENTERING AIR							
			INITIAL WATER TEMPERATURE							STEAM TEMPERATURE
	A	B	160° F.	170° F.	180° F.	190° F.	200° F.	210° F.	220° F.	215° F.
BOTCS 24	20½	24	715	850	985	1130	1270	1440	1595	1680
BOTCS 36	32½	36	1120	1335	1550	1770	2000	2260	2510	2640
BOTCS 48	44½	48	1530	1820	2110	2420	2720	3080	3420	3600
BOTCS 60	56½	60	1940	2300	2670	3065	3445	3900	4335	4560
BOTCS 72	68½	72	2350	2790	3230	3710	4170	4720	5240	5520

In selecting the elements, it should be noted that the maximum length of baseboard element that can be installed on any wall will be 12″ less than the distance between adjoining walls for one element. A further reduction in maximum length of 4″ must be allowed for each additional element to be installed. Thus, maximum length of one element = length of wall minus 12″: maximum length of two elements = length of wall minus 16″: maximum length of three elements = length of wall minus 20″.

(7) Installations having heating loads in excess of 50,000 B.T.U.'s, will require increased pipe sizes up to the point of division into circuits. Table No. 3 indicates flow and return main sizes for various B.T.U. requirements. Flow and return risers to upper floor circuits also should be in accordance with Table No. 3.

Table No. 3

TABLE OF PIPE SIZES				
Pipe Size:	1″	1¼″	1½″	2″
B.T.U. Capacity:	50,000	75,000	115,000	200,000

(8) Select a circulator of adequate capacity for the operating conditions. To determine the required circulator size proceed in the following manner:

(a) Calculate separately the flow of water in U.S. gallons per minute needed to supply the load for each circuit. This may be obtained by dividing the circuit heating (B.T.U.) load by 9600. (Weight of 1 U.S. gallon of water at operating temperature x assumed temperature drop of 20° x 60 minutes = 8 x 20 x 60 = 9600).

(b) Determine the length of each circuit measured from boiler through Baseboard units and connecting piping back to boilers with allowance for fittings as given in Table No. 4.

(c) Determine friction loss for each separate circuit, based on required U.S. gallons per minute and the length of circuit. Use values in 1″ pipe column, Table No. 5, for friction loss.

Since the friction head obtained from Table No. 5 is given for 100 feet of run, the actual head will be the value determined from Table No. 5 x length of run divided by 100.

(d) Select a circulator which develops sufficient head to overcome the resistance of the circuit having the highest friction loss. The circulator must deliver the total number of gallons per minute required by all circuits against this head.

Select the size of circulator from the performance curves. These curves indicate the approximate maximum performance of circulators for a given head and discharge.

Table No. 5

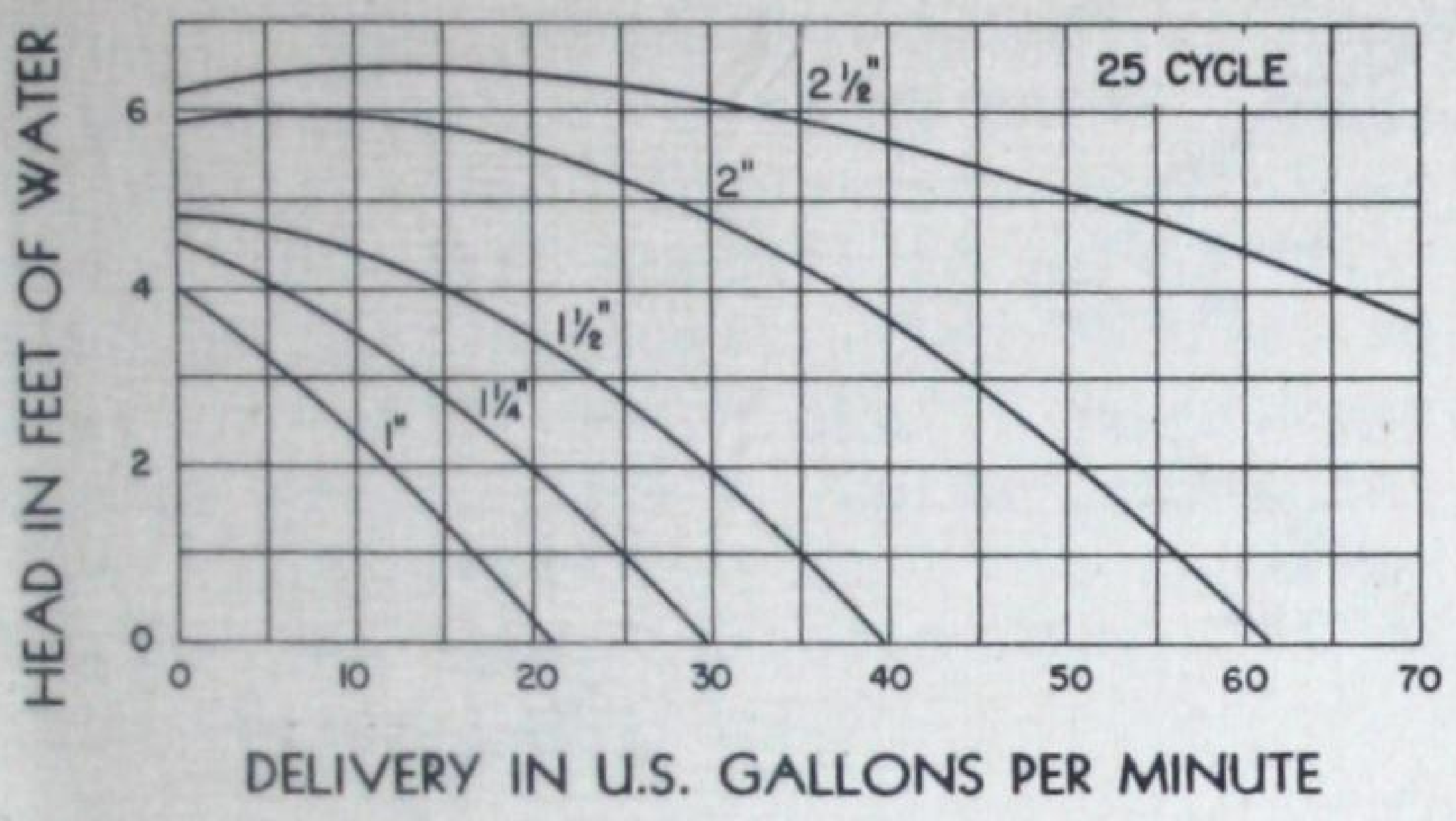
FRICTION HEAD - FEET PER EQUIVALENT 100 FT. OF PIPE

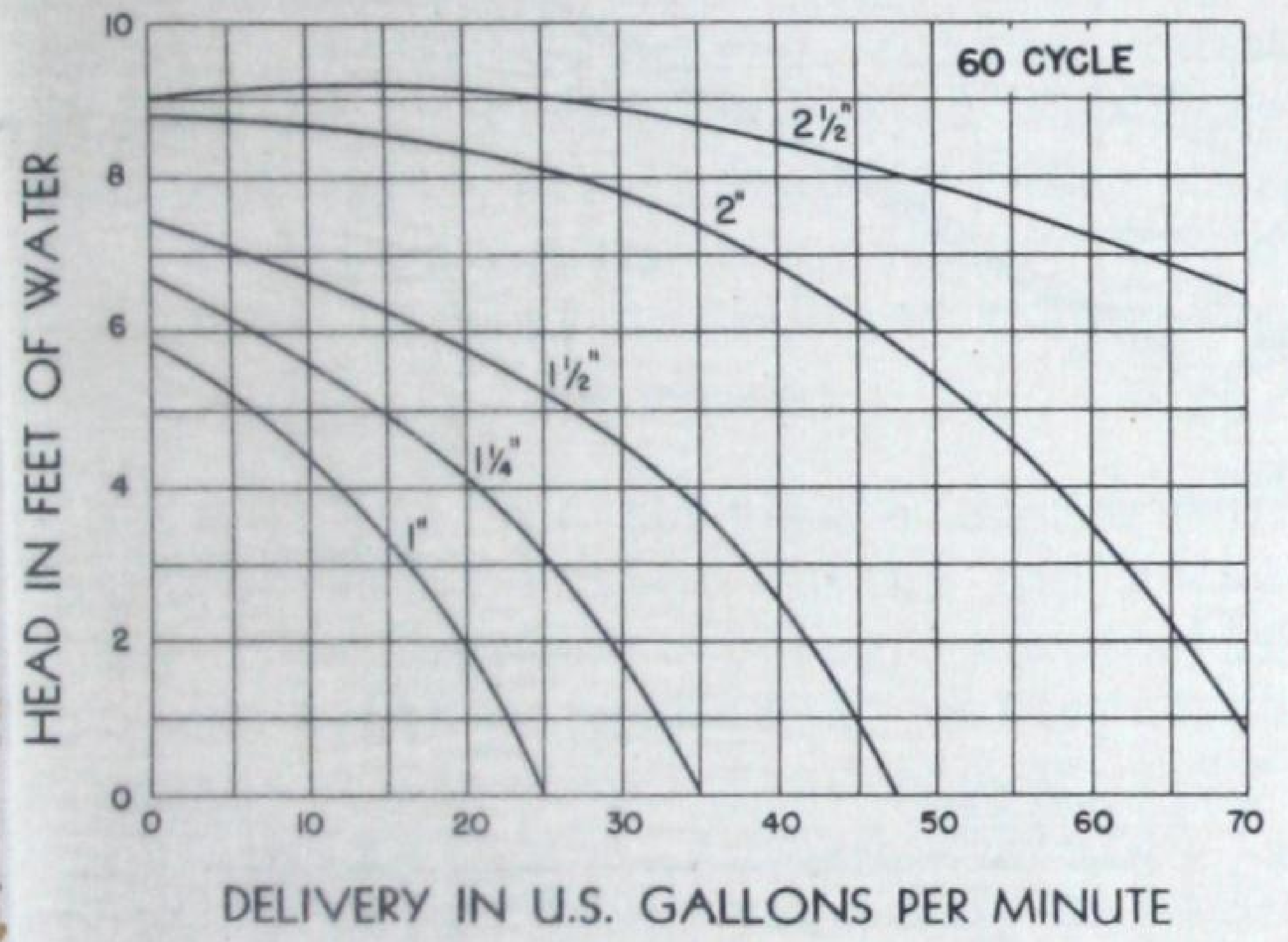
GPM	1″ Pipe	1¼″ Pipe	1½″ Pipe	2″ Pipe
1.0	0.11	0.03	0.01	—
1.5	0.23	0.06	0.03	0.01
2.0	0.38	0.10	0.05	0.01
2.5	0.54	0.15	0.07	0.02
3.0	0.81	0.21	0.10	0.03
3.5	1.08	0.28	0.13	0.04
4.0	1.38	0.35	0.16	0.05
4.5	1.67	0.43	0.21	0.06
5.0	2.08	0.52	0.24	0.07
5.5	2.34	0.62	0.29	0.08
6.0	2.92	0.73	0.35	0.10
6.5	3.34	0.83	0.38	0.12
7.0	3.75	1.00	0.45	0.13
7.5	4.16	1.1	0.50	0.15
8.0	4.84	1.2	0.58	0.17
8.5	5.50	1.4	0.63	0.19
9.0	5.84	1.5	0.70	0.22
9.5	6.34	1.7	0.76	0.24
10	7.26	1.8	0.88	0.26
11	8.15	1.9	1.0	0.28
12	10.0	2.3	1.1	0.34
13	11.6	2.9	1.4	0.41
14	13.4	3.3	1.6	0.46
15	15.0	3.8	1.8	0.53
16	15.8	4.2	1.9	0.57
17	17.5	4.5	2.2	0.64
18	20.8	5.2	2.5	0.68
19	23.3	5.8	2.8	0.78
20	25.0	6.5	3.1	1.0
25	38.3	10.0	4.6	1.3
30	53.3	14.2	6.4	1.9
35	70.8	18.4	8.3	2.4
40	91.5	23.4	10.8	3.2
45	—	29.2	14.1	3.9
50	—	34.2	15.7	4.7

Table No. 4

FITTING	IRON PIPE EQUIVALENT LENGTH—FEET				COPPER TUBING EQUIVALENT LENGTH—FEET			
	1″ Pipe	1¼″ Pipe	1½″ Pipe	2″ Pipe	1″ Tube	1¼″ Tube	1½″ Tube	2″ Tube
90° Elbow	2.08	2.61	3.12	4.17	2.08	2.61	3.12	4.17
45° Elbow	1.46	1.83	2.19	2.92	1.46	1.83	2.19	2.92
Tee — percent (100%)	3.75	4.68	5.62	7.50	2.50	3.13	3.75	5.00
through (50%)	8.32	10.40	12.50	16.68	8.32	10.40	12.50	16.68
side (33%)	18.75	23.42	28.10	37.50	23.45	29.35	35.20	46.90
outlet (25%)	33.30	41.70	49.80	66.70	41.70	52.20	62.50	83.30
Globe Valve (open)	25.00	31.30	37.50	50.00	35.40	44.30	53.20	70.80
Gate Valve (open)	1.04	1.30	1.56	2.08	1.46	1.83	2.19	2.92
Stop Cock (open)	2.08	2.61	3.12	4.17	2.08	2.61	3.12	4.17
Boiler	6.25	7.82	9.36	12.50	8.32	10.40	12.50	16.68

TYPICAL CIRCULATOR PERFORMANCE CURVES—25 AND 60 CYCLE





Example:
Circuit load = 48,000 B.T.U.'s.
G.P.M. required = $\frac{48{,}000}{9{,}600}$ = 5 G.P.M.

Circuit length = 100 feet = 100.00
5-1¼″ Elbows = 5 x 2.61 = 13.05
1-1″ Elbows = 11 x 2.08 = 22.88
1-1″ Stop Cock = 1 x 2.08 = 2.08
Boiler = 10.40
148.41

rom Table No. 5, for 5 G.P.M. friction head 2.08 feet for 100 ft. run.
otal circuit friction head = $\frac{148.41 \text{ x } 2.08}{100}$
3.09 feet.

epeat for all circuits.

ssuming 3.09 feet is highest resistance of any rcuit, use this value and the total load on all rcuits to obtain circulator size.

otal load on all circuits = 90,000 B.T.U.'s.

G.P.M. required = $\frac{90{,}000}{9{,}600}$ = 9.38 G.P.M.

ghest friction head = 3.09 feet.

Assuming 25 cycle current available, from performance curves for 25 cycle, select a 1¼″ circulator.

It is recommended that selection of circulators be checked against the performance chart for the particular make of circulator to be used or specified.

(9) Select an expansion tank of adequate size from Table No. 6.

Table No. 6

TANK SIZE	CAPACITY—B.T.U.
12 x 36	150,000
12 x 48	200,000
12 x 58	250,000

(10) The net rating of the hot water heating system boiler chosen should supply the output required by the heating load + 10% for pickup load, etc. Boiler size must be increased accordingly if domestic hot water is to be supplied by indirect heater applied to the boiler.

Connections to the hot water heating system boiler include a cold water supply with stop cock or valve, a pressure relief valve and expansion tank. A flow control valve is connected into the supply main and stop cocks or gate valves, which are used to balance the system, are placed in each return circuit.

All returns pass into a common return to the circulator. A by-pass on the circulator may be used. A by-pass between circulator discharge and flow main is recommended. This by-pass must contain a balancing stop cock or gate valve. See Fig. 3185.

All equipment other than Baseboard Elements and Enclosures is to be supplied by Heating Contractor.

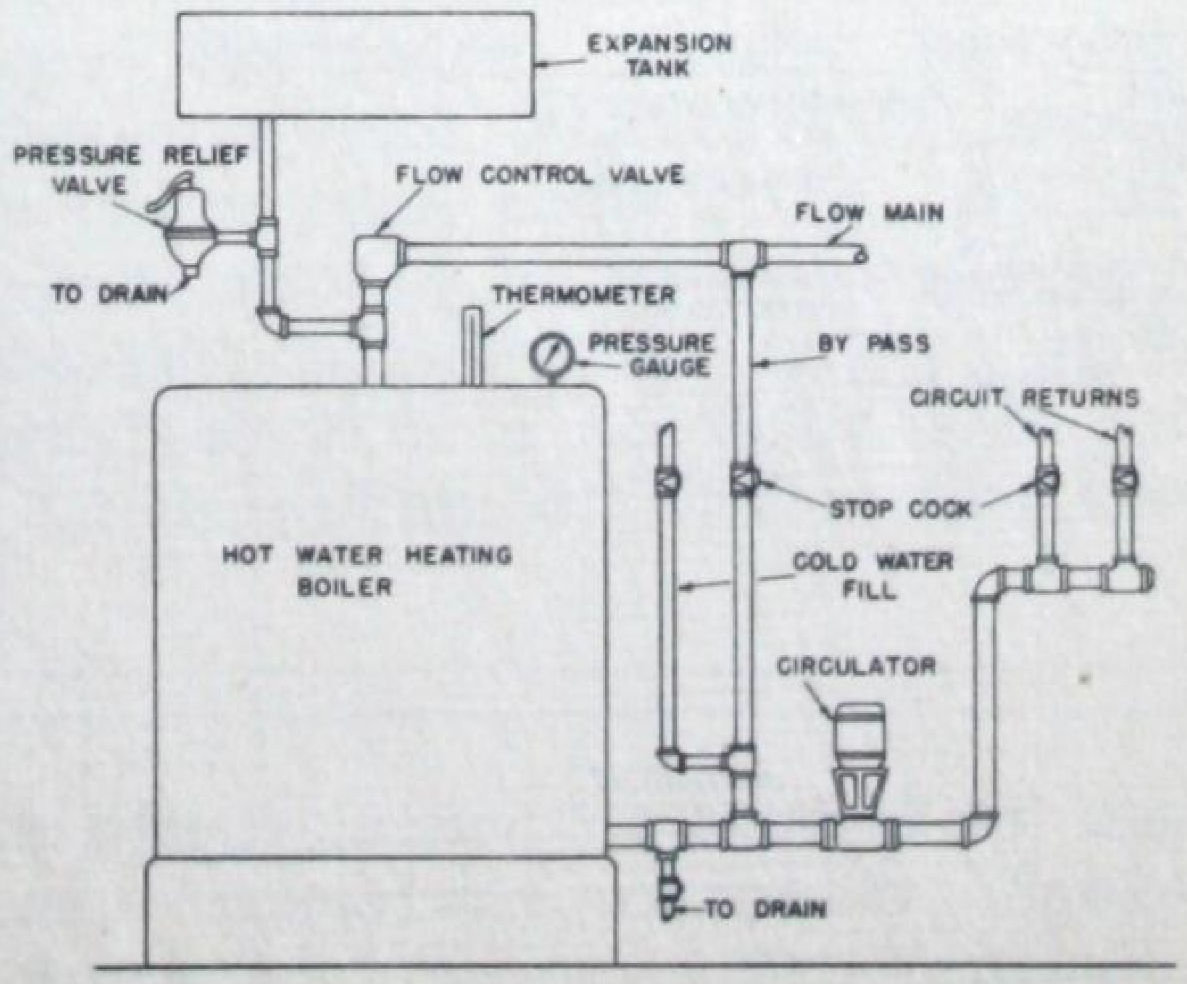


Fig. 3185—Typical Boiler Connections

TYPICAL DUNHAM BASEBOARD INSTALLATION

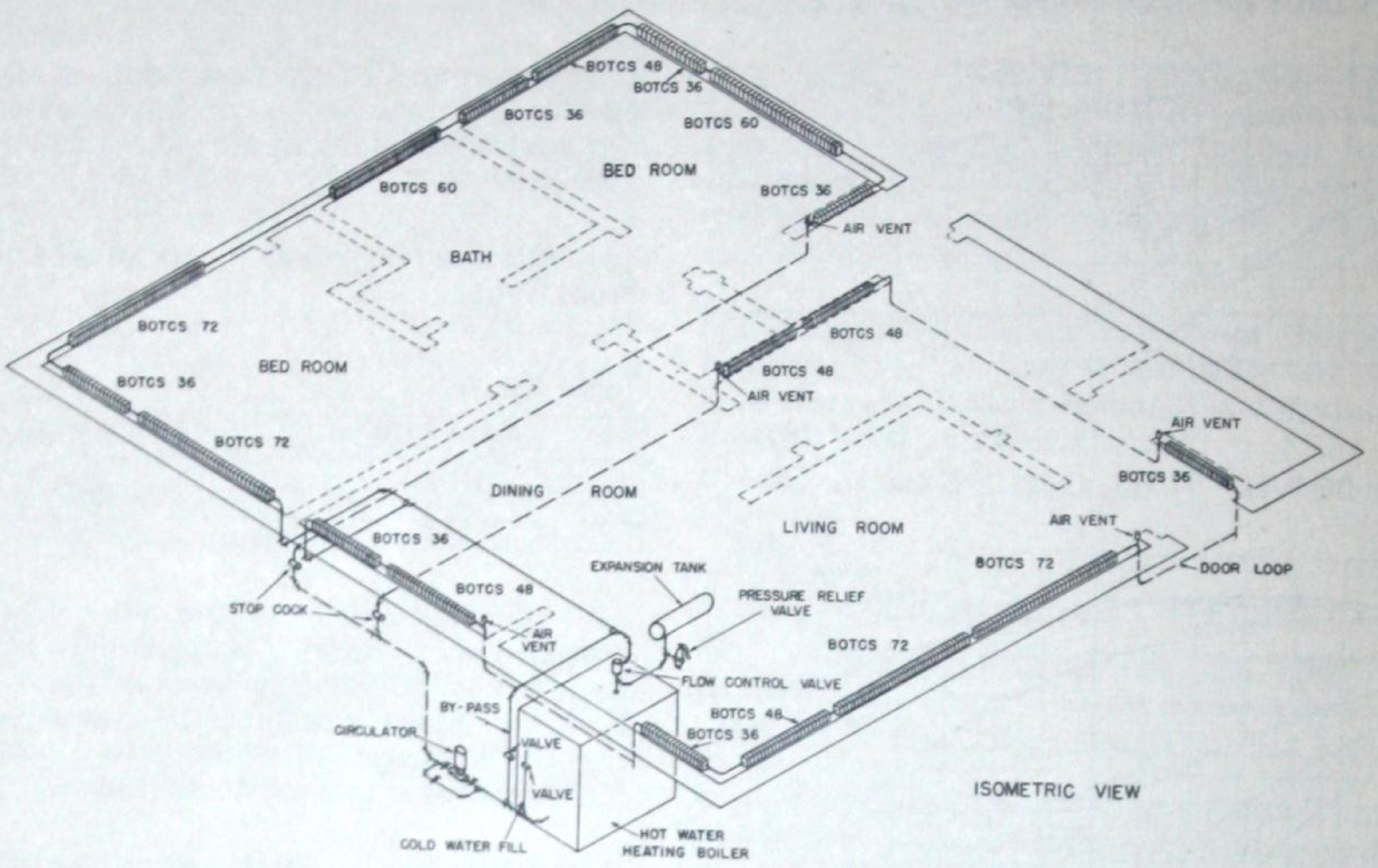


Fig. 3186 A

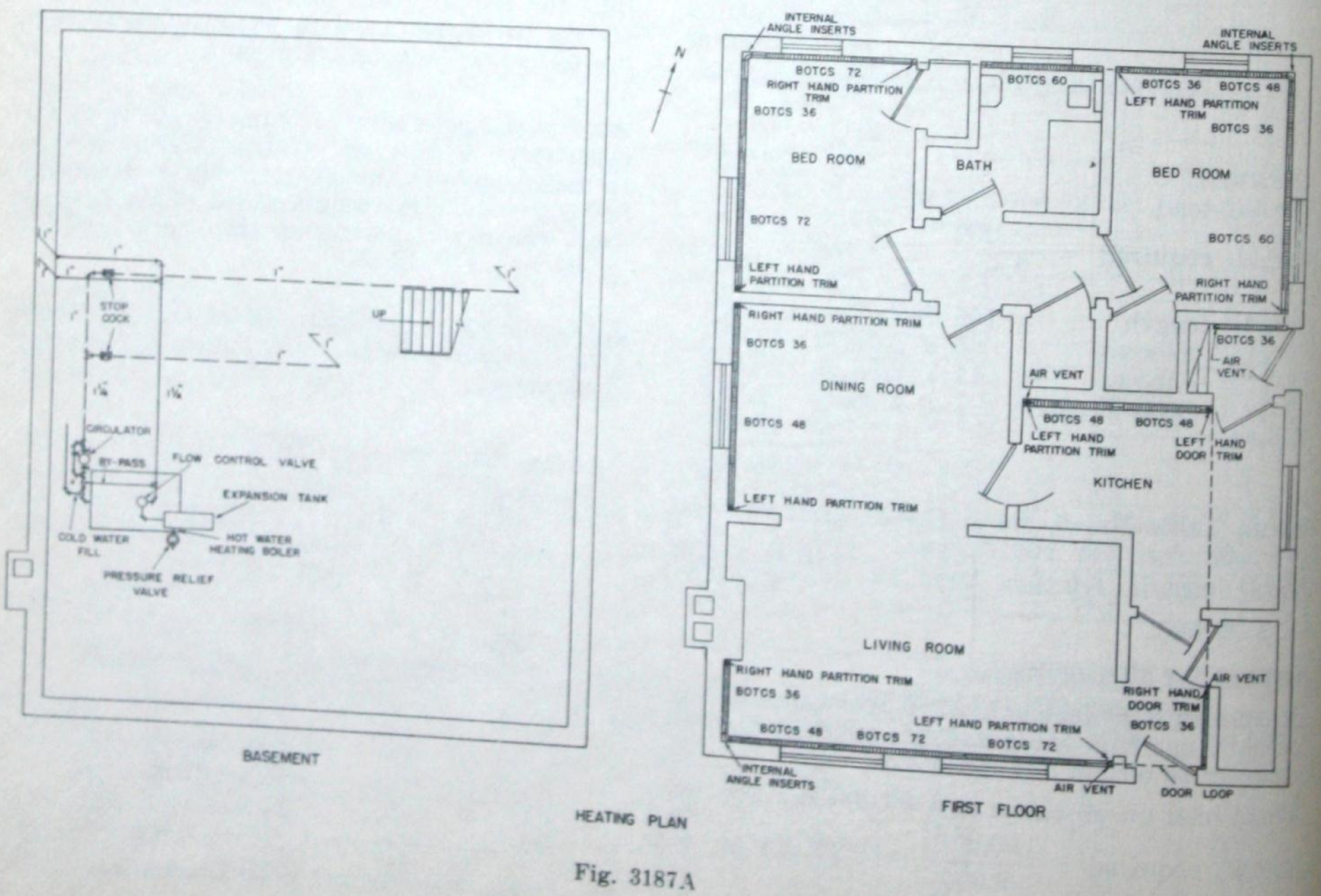


Fig. 3187A

DUNHAM OTCS CONVECTOR RADIATOR

Dunham OTCS Convector Radiators provide satisfactory heating units, particularly for Industrial Buildings where process operations may be carried on near windows. They serve to prevent cold down drafts from large window areas. These units are ideal for installation in monitors and skylights to prevent cold down drafts from these structures.

It is recommended that they be installed with cabinets where placed under windows or at working levels. In monitors and skylights however, they may be installed without cabinets with a reduction in heat output of approximately 20%.

CONSTRUCTION: The heating elements are constructed of copper tubing and steel fins. The copper tubing is suitable for use with standard 1" solder type fittings. The steel fins are 4" x 3½" x #22 gauge with formed collars in contact with copper tube and the tube expanded to a positive mechanical contact for greatest possible heat transfer from the tube to fin.

The heating elements are supplied only in overall lengths of 24", 36", 48", 60" and 72" with fins spaced 50 to the foot and ending 1-1/2" from each end of tube to permit installation of solder type fittings.

Weight of element only 7# per lin. ft.
Element and cabinet 11# per lin. ft.

CABINET CONSTRUCTION: The cabinet is of two piece construction comprising a back plate which is fastened to masonry walls by lag screws and expansion shields and to frame walls by wood screws into studs.

The outer cover is arranged to clip over back plate and is fastened at each end with screw into flange of the back plate.

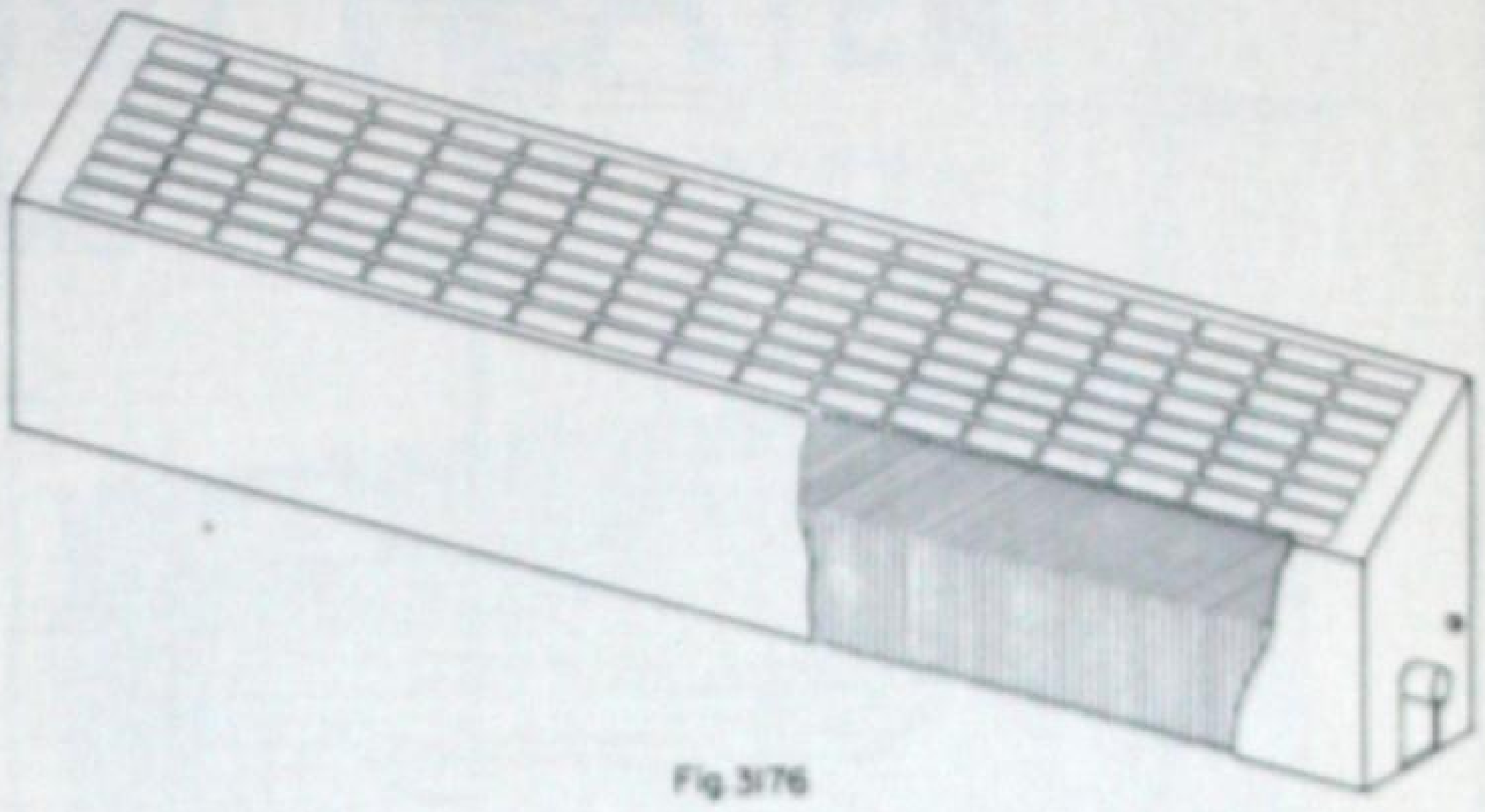


Fig 3176

The cabinet is constructed of #19 gauge steel with sloping top with outlet grille design similar to Dunham standard convector units. Bottom of cabinet is entirely open to permit free air flow over the finned heating element.

Cabinets are painted with a coat of grey metal primer.

Dunham OTCS Convector Radiator Units can be used on steam or mechanically circulated hot water heating systems.

The units may be installed in continuous runs connected together with solder type couplings for copper piping or with copper to iron pipe adapters for standard 1" steel pipe in continuous lengths up to 60' for 1# operating pressure using a steam trap and separate steam supply or up to 100' with 2# or higher operating pressure. Provision should be made for expansion and contraction of piping and where runs exceed 75', roller type hangers should be used to support connecting piping. The units should be installed with a grade of 1/2" in 10'-0" in direction of condensate flow.

See other side for method of application, dimensions, capacity tables and correction factors for various steam pressures and water temperatures.

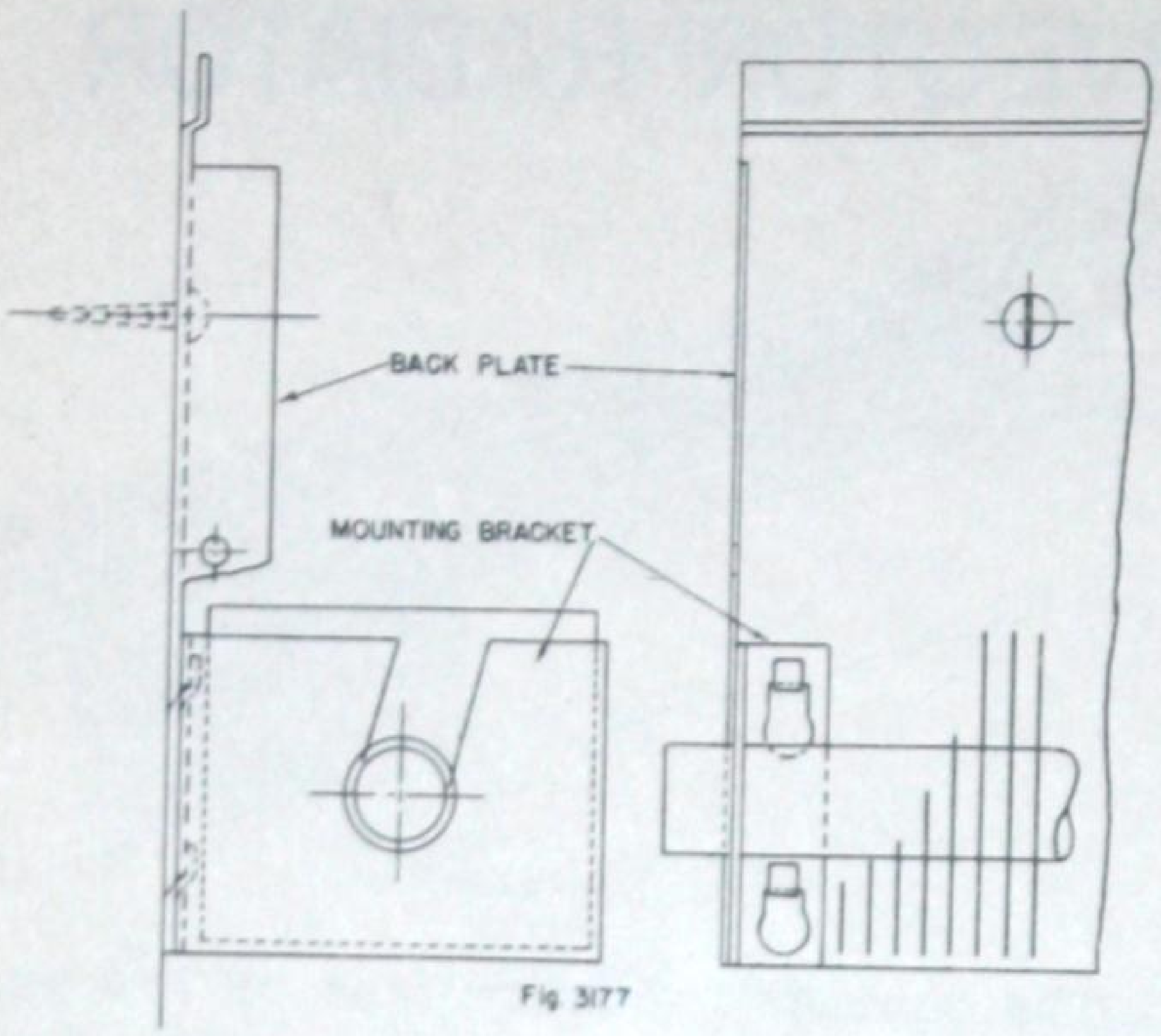
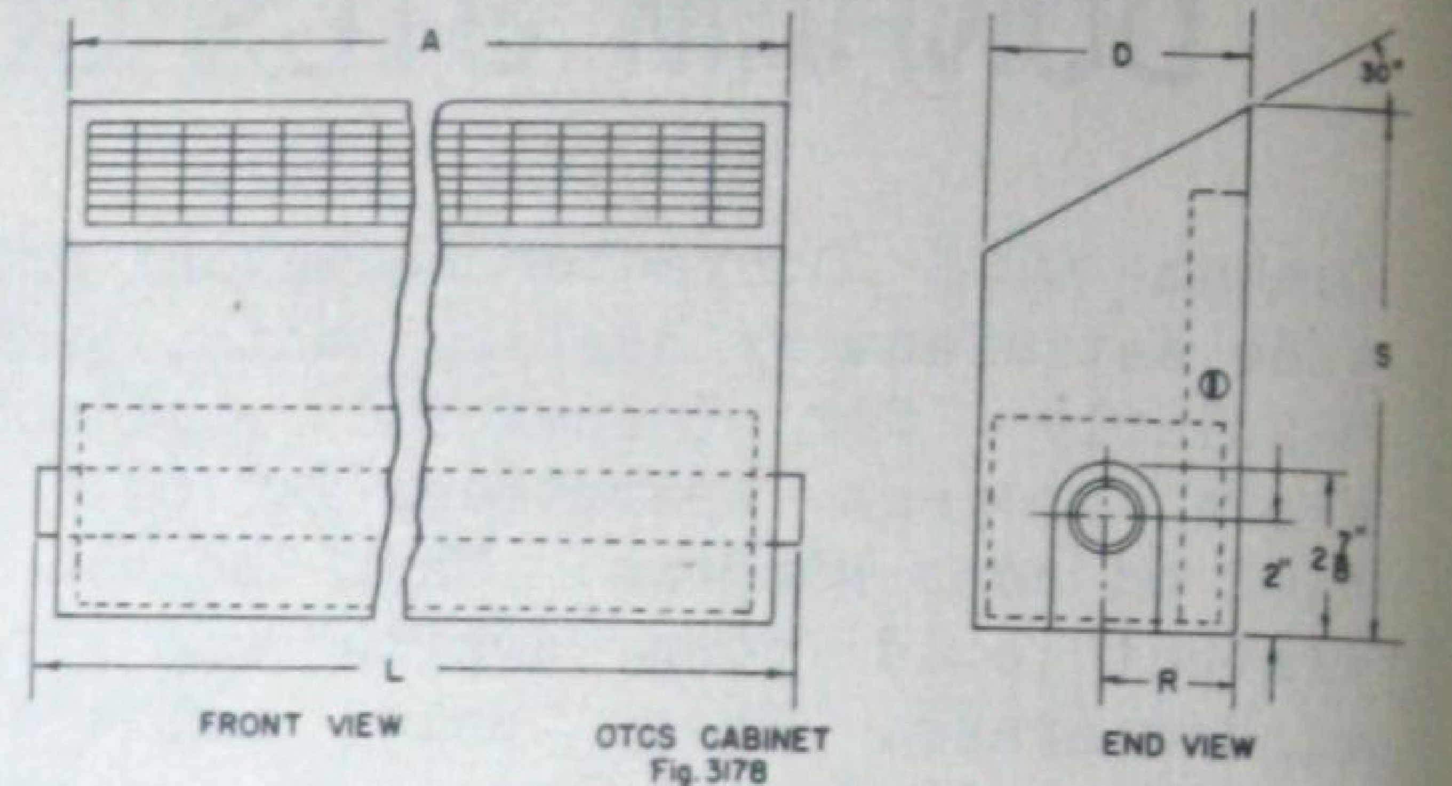


Fig 3177



OTCS CABINET
Fig. 3178

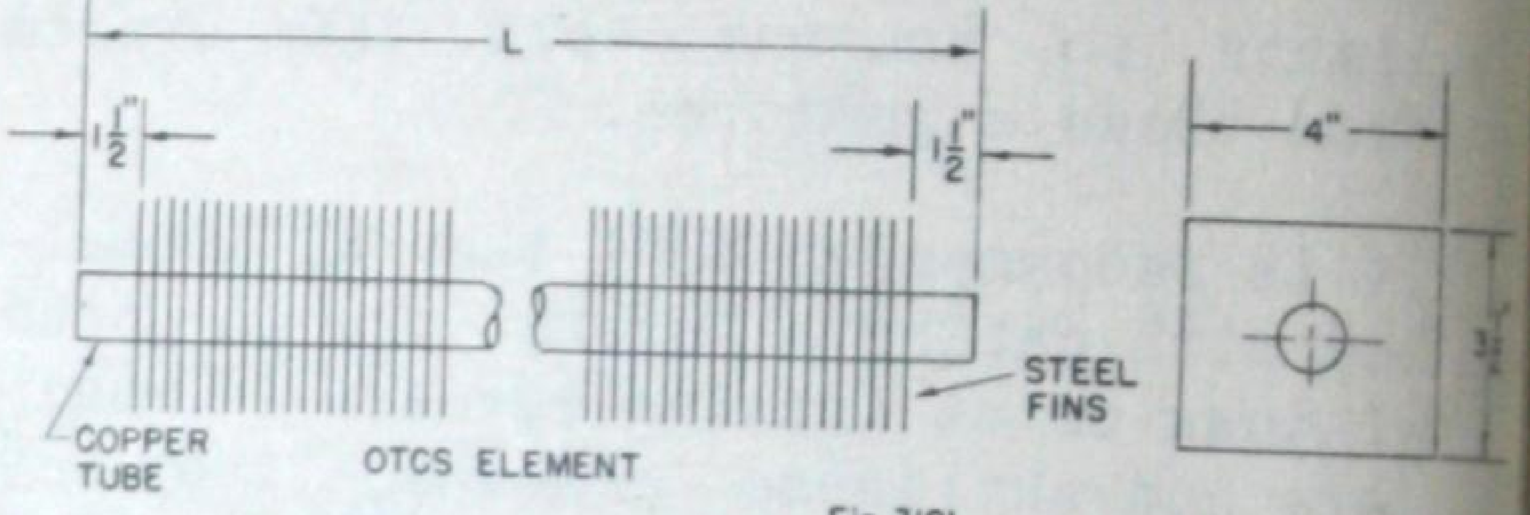


Fig. 3181

TABLE I

CAPACITIES
DUNHAM OTCS CONVECTOR UNITS

WITH 65° F ENTERING AIR AND STEAM TEMP. 215 °F

ELEMENT NUMBER	WITHOUT COVER		WITH COVER	
	BTU	EDR	BTU	EDR
OTCS - 24	2100	8.8	2520	10.5
OTCS - 36	3300	13.8	3960	16.5
OTCS - 48	4500	18.8	5400	22.5
OTCS - 60	5700	23.8	6840	28.5
OTCS - 72	6900	28.8	8280	34.5

ABLE 2

DIMENSIONS IN INCHES
DUNHAM OTCS UNITS

ELEMENT NUMBER	A	D	R	L	S
OTCS - 24	23	4.5	2.25	24	9
OTCS - 36	35	4.5	2.25	36	9
OTCS - 48	47	4.5	2.25	48	9
OTCS - 60	59	4.5	2.25	60	9
OTCS - 72	71	4.5	2.25	72	9

TABLE 3

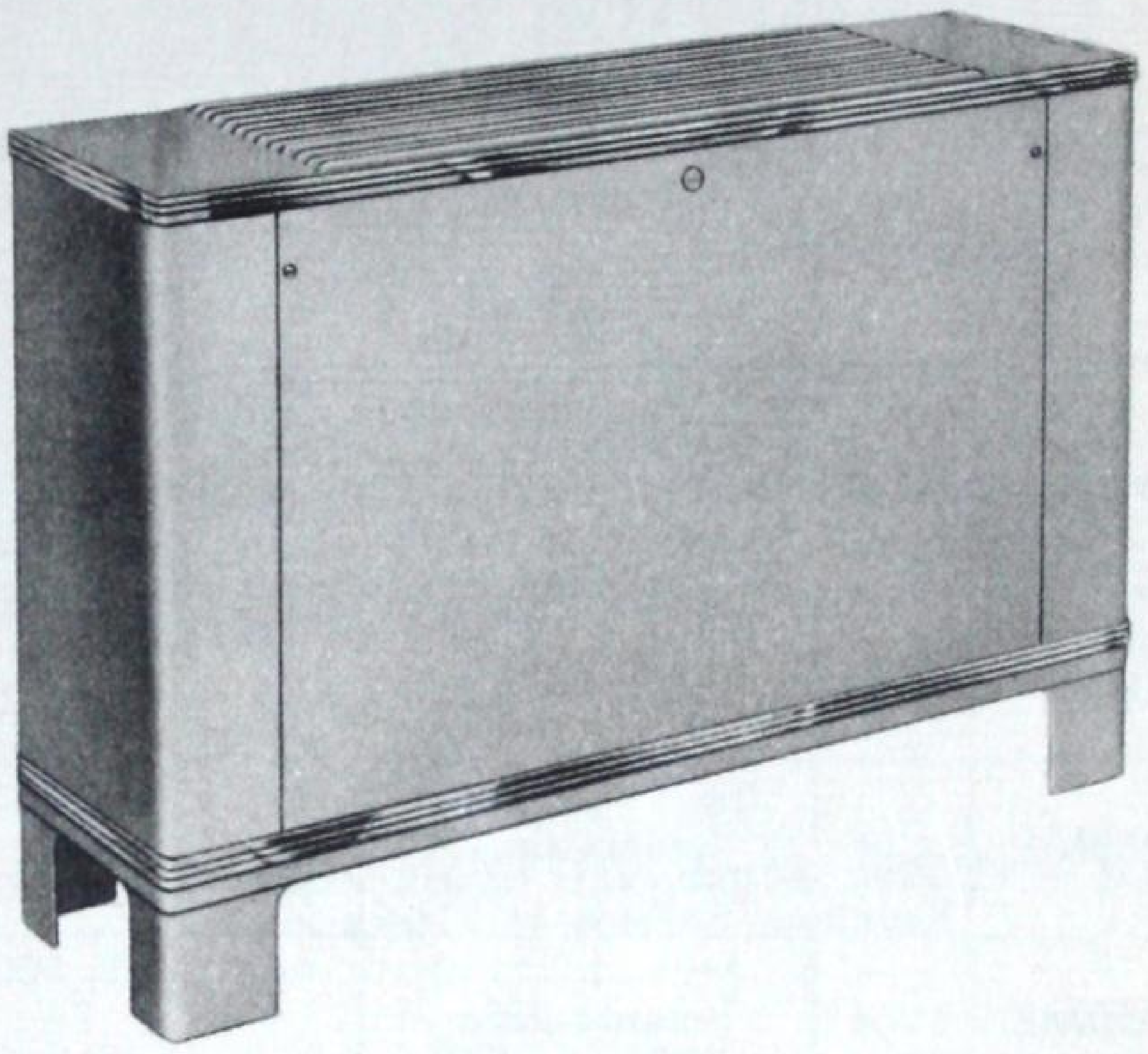
CORRECTION FACTORS FOR STEAM AND HOT WATER — OTCS CONVECTORS

A	B	ROOM TEMPERATURE						
VAC. IN HG	TEMP. °F	80	75	70	65	60	55	50
22.4	150	3.14	2.83	2.57	2.35	2.15	1.98	1.84
20.3	160	2.57	2.35	2.15	1.98	1.84	1.71	1.59
17.7	170	2.15	1.98	1.84	1.71	1.59	1.49	1.40
14.6	180	1.84	1.71	1.59	1.49	1.40	1.32	1.24
10.9	190	1.59	1.49	1.40	1.32	1.24	1.17	1.11
6.5	200	1.40	1.32	1.24	1.17	1.11	1.05	1.00
LBS. PSI								
1	215	1.17	1.108	1.053	1.000	.952	.900	.866
5	227	1.03	.980	.933	.891	.851	.814	.781
15	249	.837	.800	.767	.736	.707	.680	.655
25	267	.718	.690	.663	.639	.615	.594	.575
50	298	.570	.551	.534	.516	.500	.485	.470
60	307	.537	.520	.505	.488	.474	.459	.447
70	316	.506	.490	.476	.462	.449	.436	.423
80	324	.480	.467	.453	.440	.429	.416	.405
90	331	.461	.448	.436	.423	.411	.390	.390
100	338	.443	.430	.418	.407	.395	.386	.376
125	353	.407	.397	.356	.377	.366	.356	.349

TO DETERMINE CONVECTOR B.T.U. OUTPUT FOR CONDITIONS OTHER THAN 215°F STEAM OR WATER TEMPERATURE AND 65°F ENTERING AIR TEMPERATURE, DIVIDE B.T.U. VALUES IN TABLE NO. 1 BY FACTORS IN TABLE NO. 3.

DUNHAM
VARI-TEMP UNIT HEATER
TYPE ME

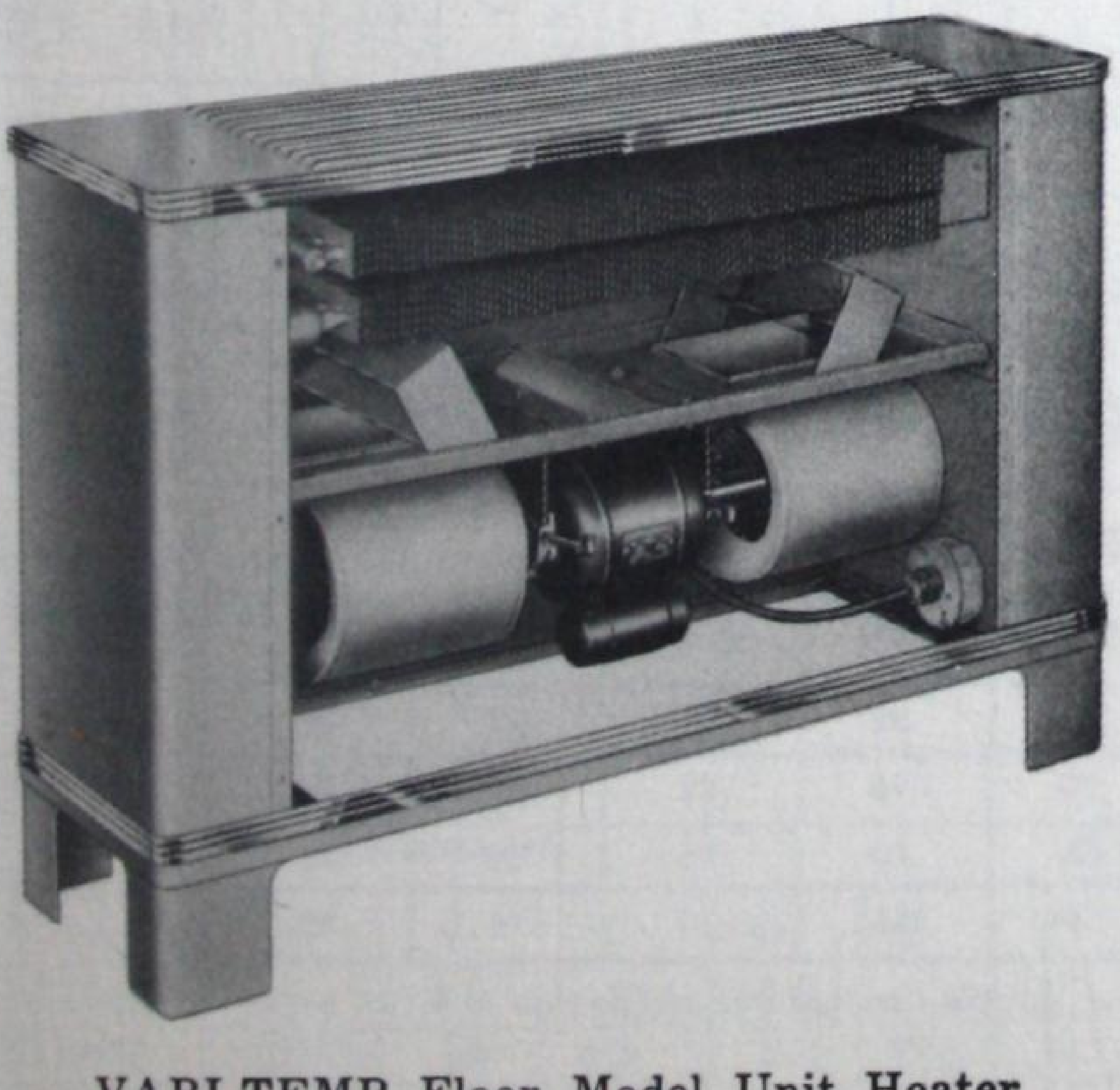
he Dunham VARI-TEMP Unit Heater is a ımpact unit of high heating capacity and :tractive appearance. It is particularly applic- ıle to stores, office buildings, factories, res- ıurants, show-rooms, churches, hospitals, audi- ıriums, vestibules and recreation rooms. The ıit may be mounted on floors, walls or ceilings. 'all mountings may be upright or inverted. loor mounted heaters are furnished with a ıitable base. Wall or ceiling mounted heaters ·e furnished with hanger frame but without ıe standard base. Units must be ordered for ıe position in which they are to be set.



VARI-TEMP Floor Model Unit Heater

ONSTRUCTION

he cabinet is constructed of highest quality ırniture steel and is designed for maximum gidity and strength. A removable front panel rovides quick and easy access to the heating ement and fan assembly. A space is provided ır all piping connections to be made inside the ıbinet and the top and side panel assembly is ·movable to facilitate piping installation. The ack of the cabinet is recessed to receive the anger frame which is used for wall or ceiling ıounting. With this arrangement the unit is ıounted tight to the wall so that after instal- ıtion, no means of hanging are visible.



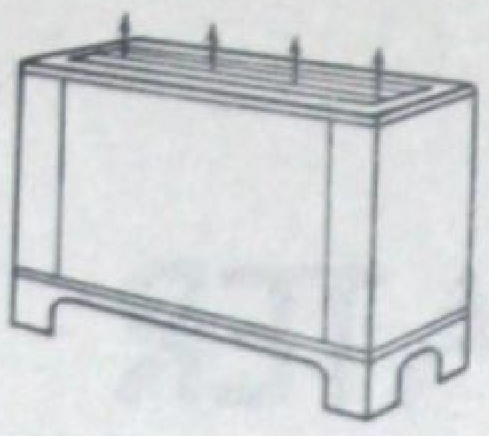
VARI-TEMP Floor Model Unit Heater
with front removed

The cabinet is supplied with hammered effect gray finish and chrome trimming.

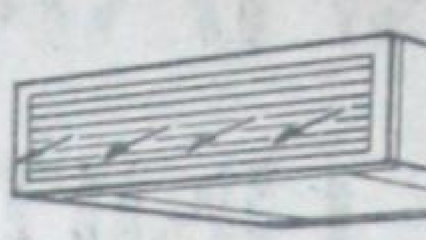
The fan and motor assembly consists of two centrifugal fans applied directly to a double ended shaft, totally enclosed capacitor type motor. The motor is controlled by a remotely mounted multi-speed switch which enables the use of a range of speeds to meet varying conditions. The fans and motor are bolted to a removable base which is insulated from its supports in order to reduce vibration to a minimum. Baffles above the fan outlets distribute the air evenly over the heating element.

THE HEATING ELEMENT

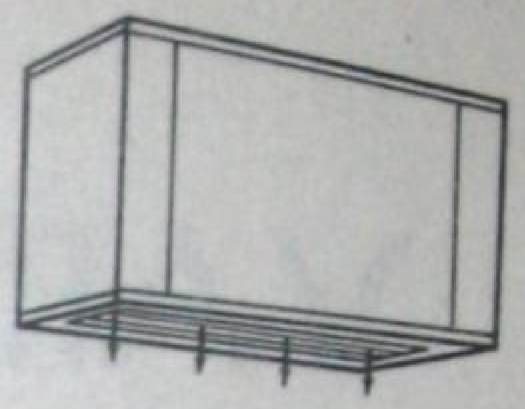
The non-ferrous heating element consists of a double row of fins securely bonded for efficient heat transfer to seamless copper tubing. The tubes are welded to bronze supply and return headers which are located at the same end of the element and are anchored to the casing assembly. The opposite end of the heating element consists of a return bend and is not anchored to the cabinet. This allows for expansion and contraction and eliminates strain and noise. The tubes are properly graded downwards from supply to return header to provide complete drainage.



Floor Mounting



Ceiling Mounting



Inverted Wall Mounting

CAPACITY DATA - VARI-TEMP UNIT HEATERS

NOTE: Select these units on the basis of normal EDR for quiet, continuous operation at an intermediate speed position. Maximum output for heating-up periods may be obtained with some sacrifice in quietness.

Unit No. and Normal E.D.R.	Motor			Unit E.D.R.	Steam at 2 P.S.I. Ga. and Entering Air at 60° F.				Shipping Weight	Tappings	
	H.P.	R.P.M.			B.T.U. per hour	Cond. Lb. per hour	Outlet Air Temp.	C.F.M. at 70°		Supply	Return
		25 Cycle	60 Cycle								
100ME	1/30	1300 Intermediate 650	1500 750	108 + 67	26,000 + 16,000	26.9 + 16.6	138.3 + 146.5	306 + 153	120 lbs.	¾"	¾"
250ME	1/4	1425 Intermediate 720	1140 570	300 + 185	72,000 + 44,300	74.5 + 45.9	130.7 + 144.5	938 + 500	225 lbs.	1"	1"
350ME	1/4	1425 Intermediate 720	1140 570	423 + 258	101,500 + 62,000	105.0 + 64.1	133.6 + 144.6	1270 + 675	250 lbs.	1¼"	1¼"

+These values vary between high and low speed values, depending on setting of the control unit.

CONSTANTS TO DETERMINE CAPACITIES OF VARI-TEMP UNITS FOR CONDITIONS OTHER THAN 2 P.S.I. STEAM AND 60° F. ENTERING AIR

Steam Pressure Lbs. Sq. In. Gauge	ENTERING AIR TEMPERATURE											
	−10° F.	0° F.	10° F.	20° F.	30° F.	40° F.	50° F.	60° F.	70° F.	80° F.	90° F.	100° F.
0 2 5	1.538 1.585 1.640	1.446 1.495 1.550	1.369 1.405 1.456	1.273 1.320 1.370	1.191 1.237 1.289	1.110 1.155 1.206	1.034 1.078 1.127	0.956 1.000 1.050	0.881 0.926 0.974	0.809 0.853 0.901	0.739 0.782 0.829	0.671 0.713 0.760
10 20 30	1.730 1.861 1.966	1.639 1.769 1.871	1.545 1.675 1.775	1.460 1.584 1.684	1.375 1.498 1.597	1.290 1.416 1.509	1.211 1.333 1.429	1.131 1.251 1.346	1.056 1.174 1.266	0.982 1.097 1.190	0.908 1.024 1.115	0.838 0.952 1.042

To determine capacity at any steam and air temperature other than shown in Steam System Capacity Table — multiply standard steam capacities by constants in this table.

CONSTANTS TO DETERMINE THE B.T.U. OUTPUT OF VARI-TEMP UNITS ON HOT WATER SERVICE WITH MECHANICAL CIRCULATION

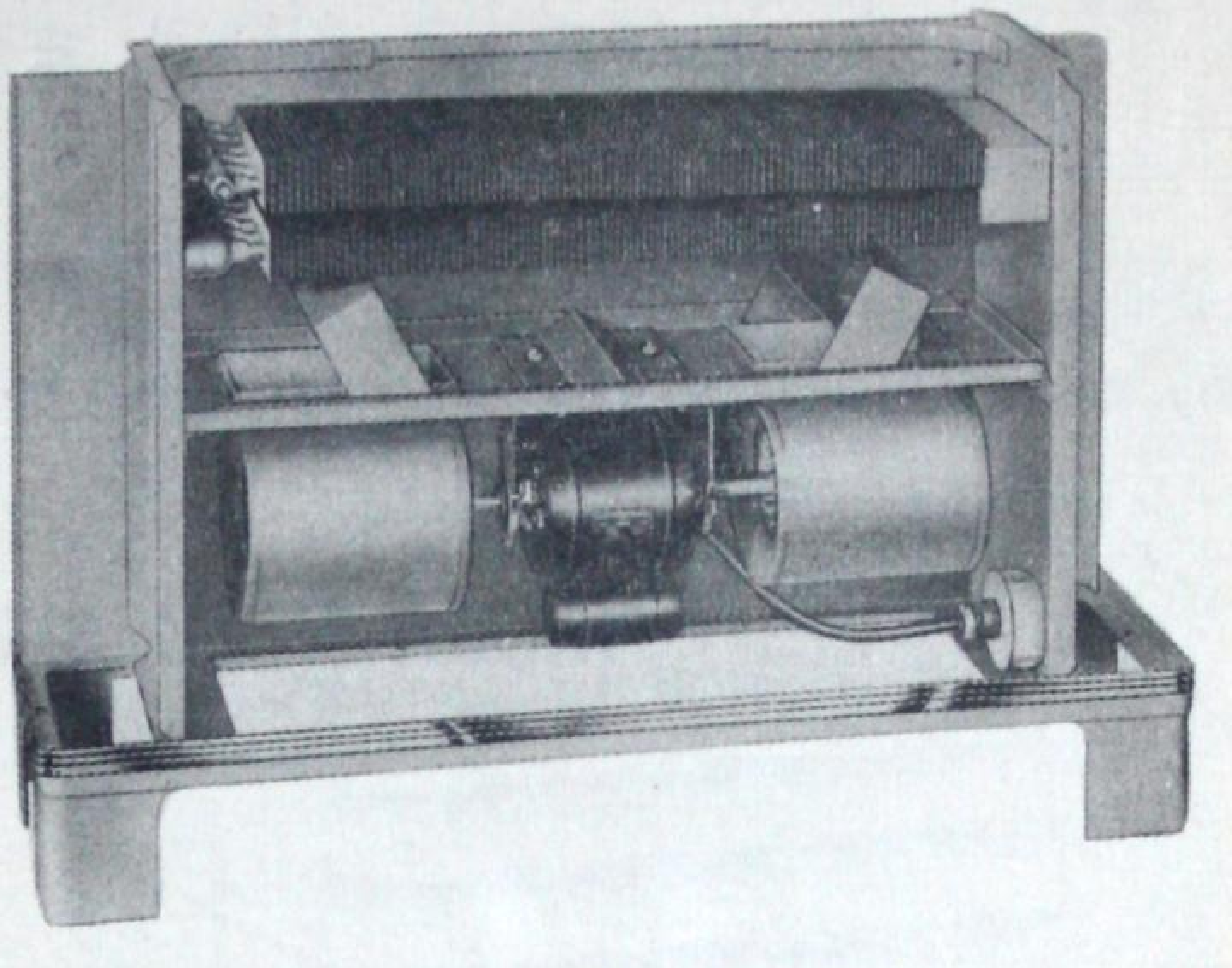
Entering Air Temp. ° F.	INLET WATER TEMPERATURE ° F.								
	140	150	160	170	180	190	200	210	220
50	.53	.59	.65	.70	.76	.82	.88	.93	.98
60	.46	.53	.59	.65	.70	.76	.82	.88	.93
70	.41	.46	.53	.59	.65	.70	.76	.82	.88
80	.35	.41	.46	.53	.59	.65	.70	.76	.82

To determine capacity at any water and entering air temperature; multiply standard steam capacities in B.T.U. by constants in this table.

To determine Hot Water EDR (Equivalent Direct Radiation) values, divide Hot Water B.T.U. values by 150.

DUNHAM VARI-TEMP UNIT HEATER INSTALLATION DIMENSIONS

Quick and easy access is provided to interior sections of the VARI-TEMP Unit Heater, Accessibility is provided by a removable front panel which exposes the heating element and fan assembly for periodic inspection, cleaning and motor lubrication. The front is held rigidly in position by panel locking screws. To remove the front, all that is necessary is to release the locking screws and give an upward and outward movement to the panel. It can be replaced with equal simplicity. A separately removable component consisting of ends and top section of the cabinet facilitates piping connections inside the unit. This component is removed by releasing screws in the flange behind the front panel and at rear of each end of the cabinet.



VARI-TEMP Floor Model Unit Heater with front panel, ends and top section removed

PIPING CONNECTIONS

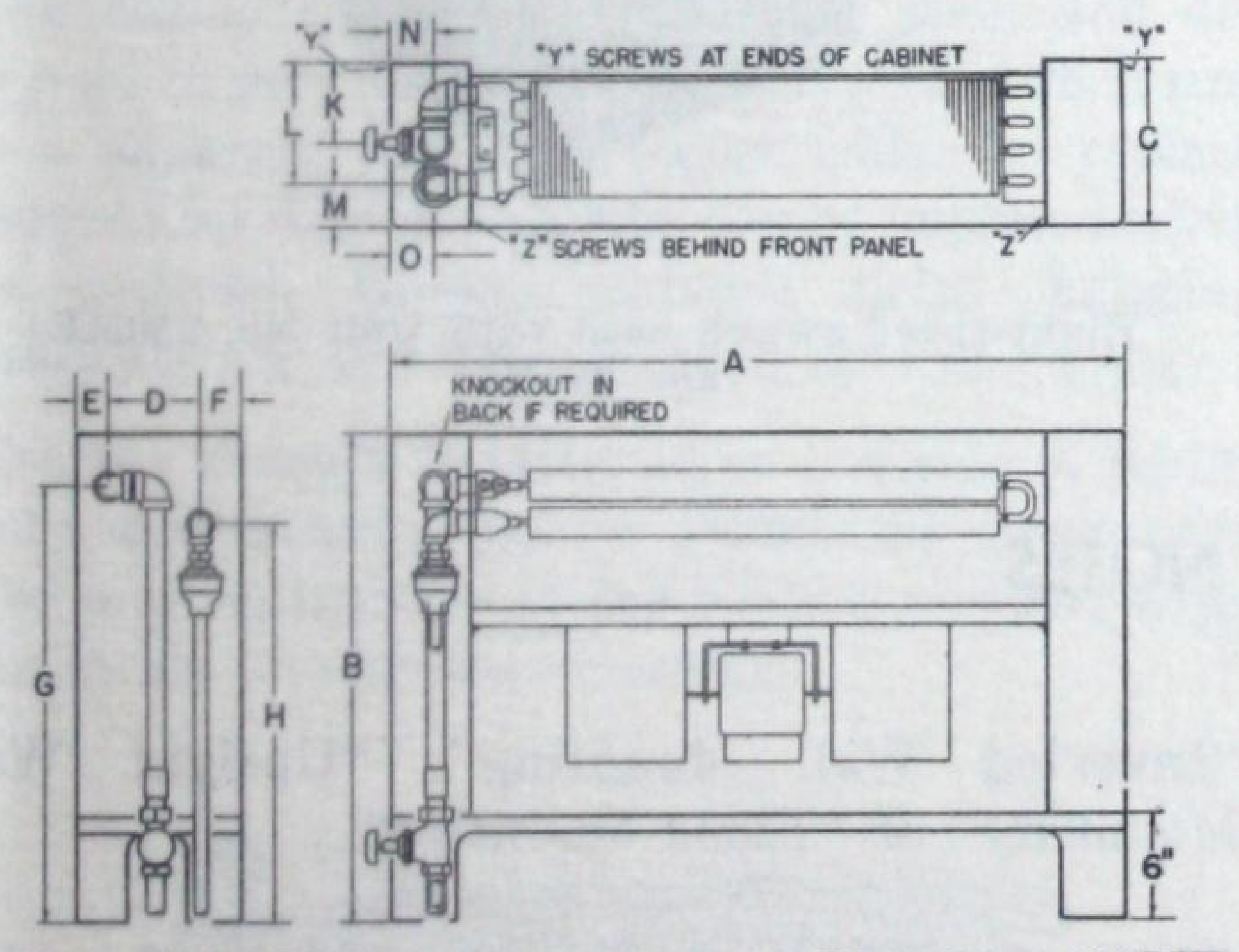

"Y"
N
"Y" SCREWS AT ENDS OF CABINET
"Y"
L
K
M
C
O
"Z" SCREWS BEHIND FRONT PANEL
"Z"
E
D
F
A
KNOCKOUT IN BACK IF REQUIRED
G
H
B
6"

Fig. 4012—Piping connections to Unit No. 100ME

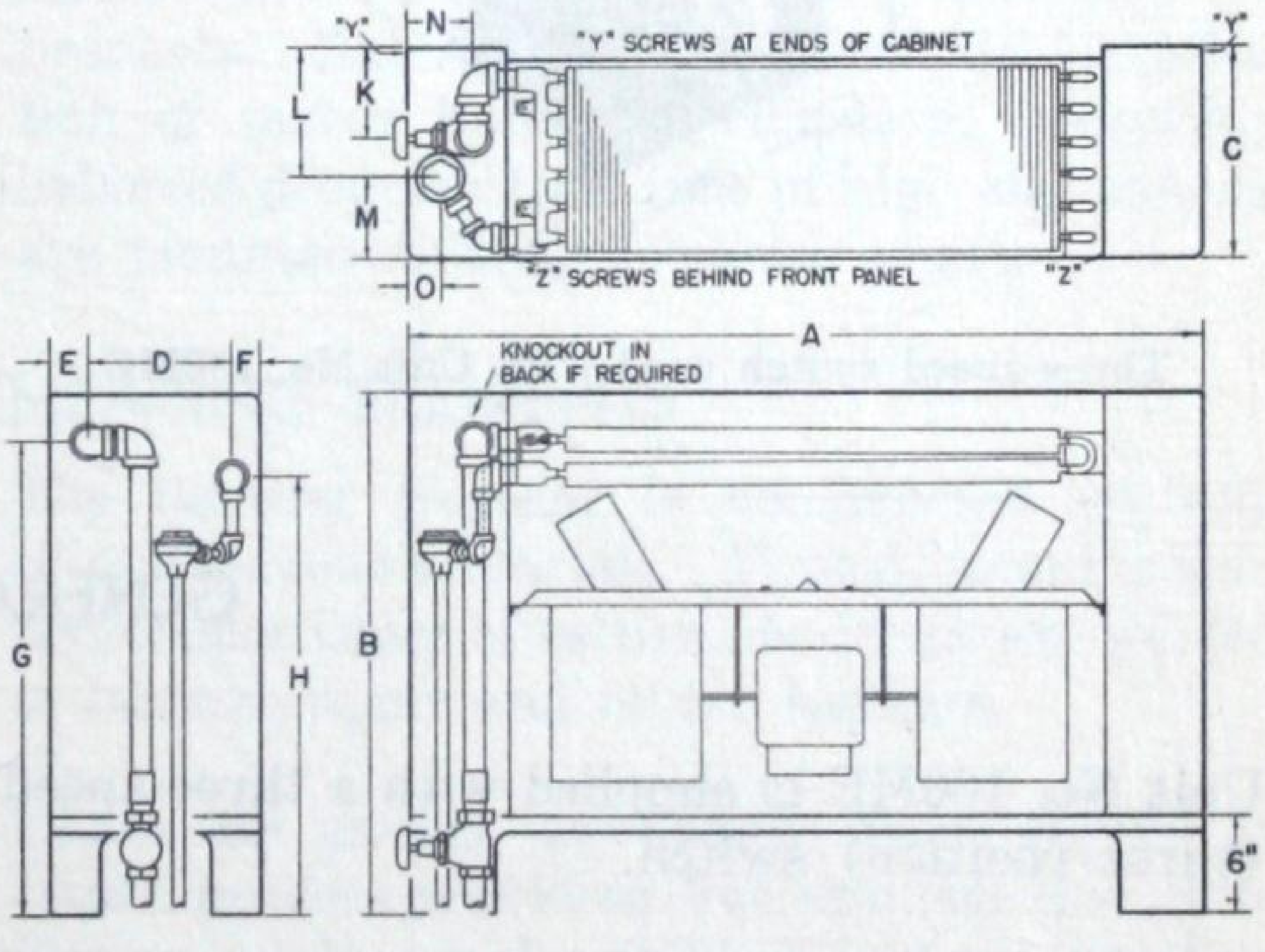

"Y"
N
"Y" SCREWS AT ENDS OF CABINET
"Y"
L
K
M
C
O
"Z" SCREWS BEHIND FRONT PANEL
"Z"
E
D
F
A
KNOCKOUT IN BACK IF REQUIRED
G
H
B
6"

Fig. 4013—Piping connections to Unit No. 250ME and 350ME

To remove top and end assembly to facilitate piping connections, take out screws "Y" and "Z" at each end of unit.

Unit No. and Normal E.D.R.	Overall Dimensions			Roughing-In Dimensions—Inches											Tapping Size Inches	Trap Size
	A	B	C	D	E	F	G	H	K	L	M	N	O			
100ME	42	28	9½	5¼	1⅞	2⅜	25	22 13/16	4⅝	7⅛	2⅜	2½	2½	¾	1B
250ME	48½	32	13	8¾	2½	1¾	29	26 13/16	5⅝	8	5	3⅛	2	1	2C
350ME	48½	32	16½	12¼	2½	1¾	29	26 13/16	6¼	11	5½	3⅛	2	1¼	3B

HANGER DIMENSIONS

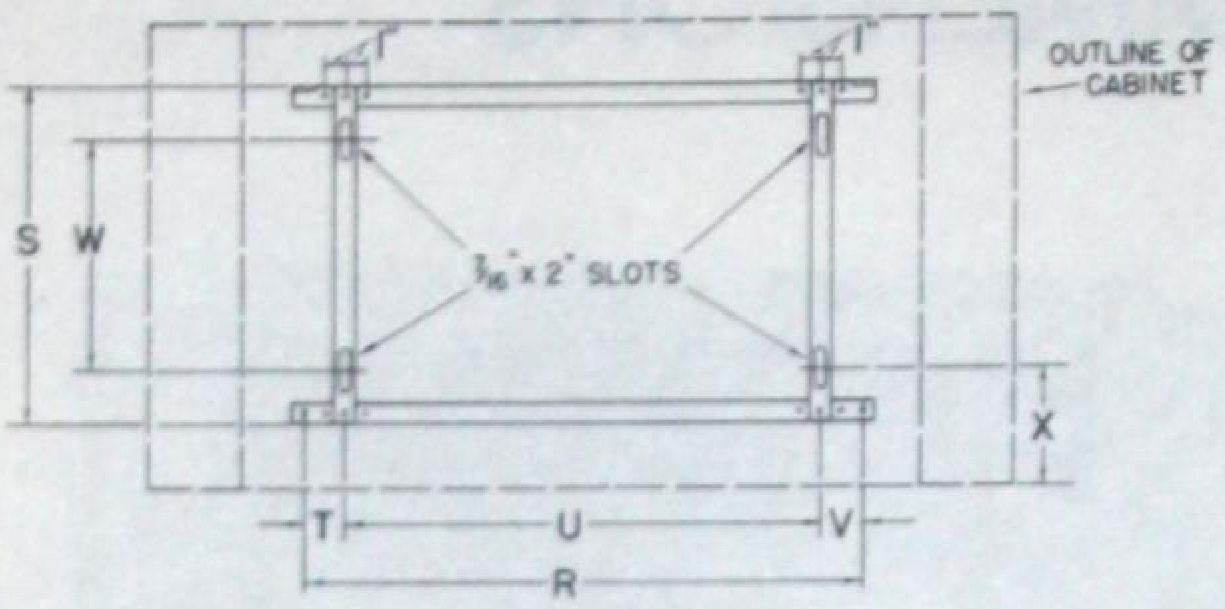
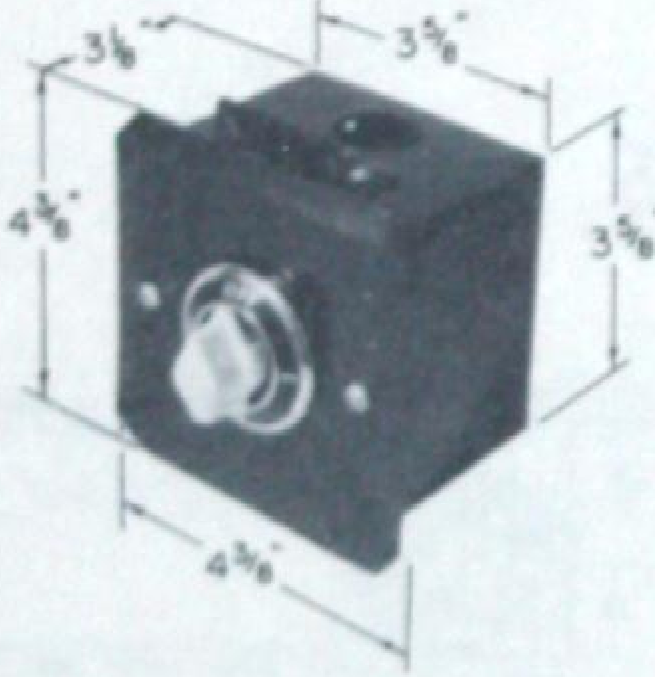


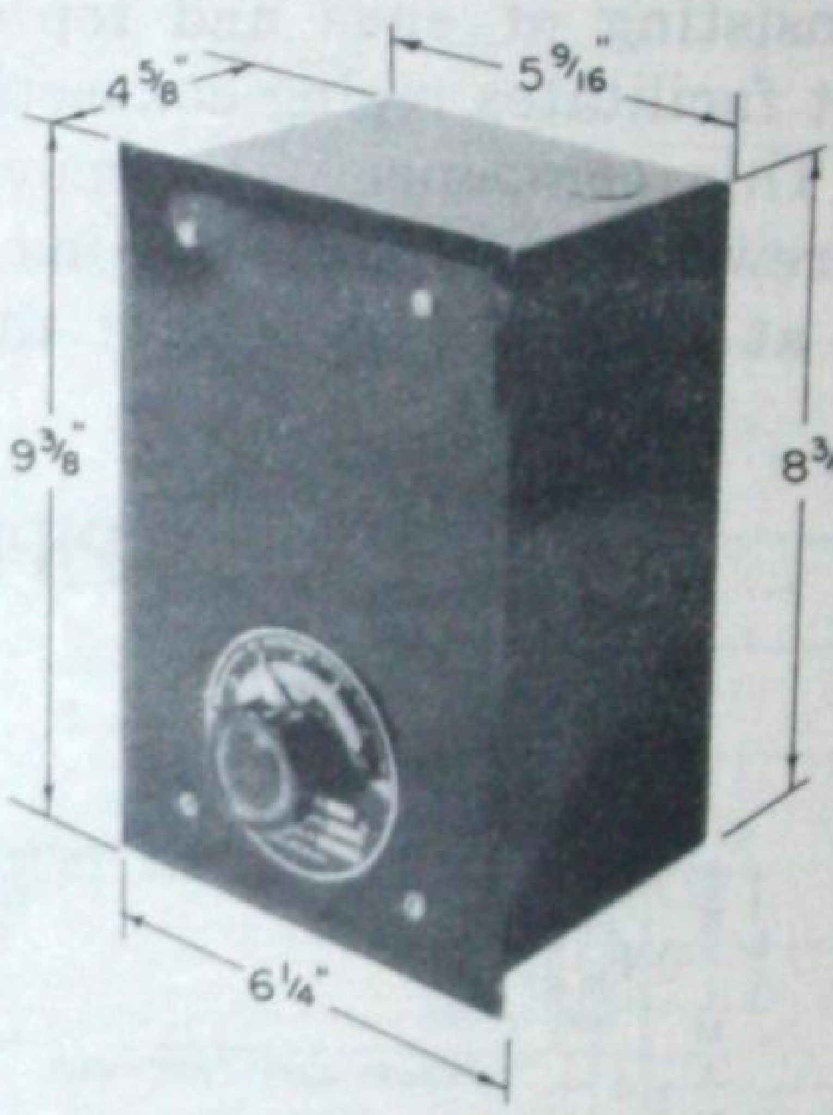
Fig. 4014—Hanger in position on back of cabinet for wall or ceiling mounting

Unit No. and Normal E.D.R.	Hanger Dimensions—Inches						
	R	S	T	U	V	W	X
100ME	27	16	2½	22	2½	11	5½
250ME	32	20	2½	27	2½	15	5½
350ME	32	20	2½	27	2½	15	5½

MULTI-SPEED SWITCH DIMENSIONS



Three-speed switch used with Unit No. 100ME



Eight-speed switch used with Unit No. 250ME and 350ME

GENERAL NOTES

Unit No. 100ME is supplied with a three speed (three position) switch.

Unit No. 250ME and 350ME are supplied with multi-speed (eight position) switch.

The exact voltage must always be specified.

Speed controllers are shipped separately for remote installation. Units must not be operated without controllers.

The type of mounting to be used must always be given on orders, viz: "Ceiling Mounting", "Inverted Wall Mounting", "Upright Wall Mounting" or "Floor Mounting".

When the unit is to be mounted behind a wall, handling its air through grilles in the face of the wall, the standard upright or inverted wall mounting is used, as desired. The necessary duct work or elbows must be built on the job.

When the unit is installed in a position where it is exposed on all sides, a special panel is provided for the rear, matching the removable front panel.

DUNHAM TYPE VF, VFM & VFW UNIT HEATERS

(WITH PROPELLER TYPE FANS)

Dunham Unit Heaters are made in sizes 125 to 1024 (steam), and 140 to 1120 (hot water), square feet of equivalent direct radiation. Design, construction, installation and performance features ensure a high ratio of heating satisfaction to first costs and operating costs.

They are designed with the object of providing reasonably low outlet air temperatures to minimize stratification of heated air which is usually experienced with high outlet temperatures. The VFM units will provide outlet temperatures with steam at 30 P.S.I.—approximately that obtained by VF units with steam at 2 P.S.I.

VFW Units are for use on mechanically circulated hot water systems.

CONSTRUCTION

The casing is built of furniture steel and designed to provide rigid assembly. Louvre frame is a separate unit and outlet collar to replace ouvres for duct connection can be supplied when so ordered. Simple balance point hanging brackets are provided at each side of casing.

Heating element is fastened to one side of casing only with internal guides permitting free expansion and contraction of the heating element without strain on element or casing.

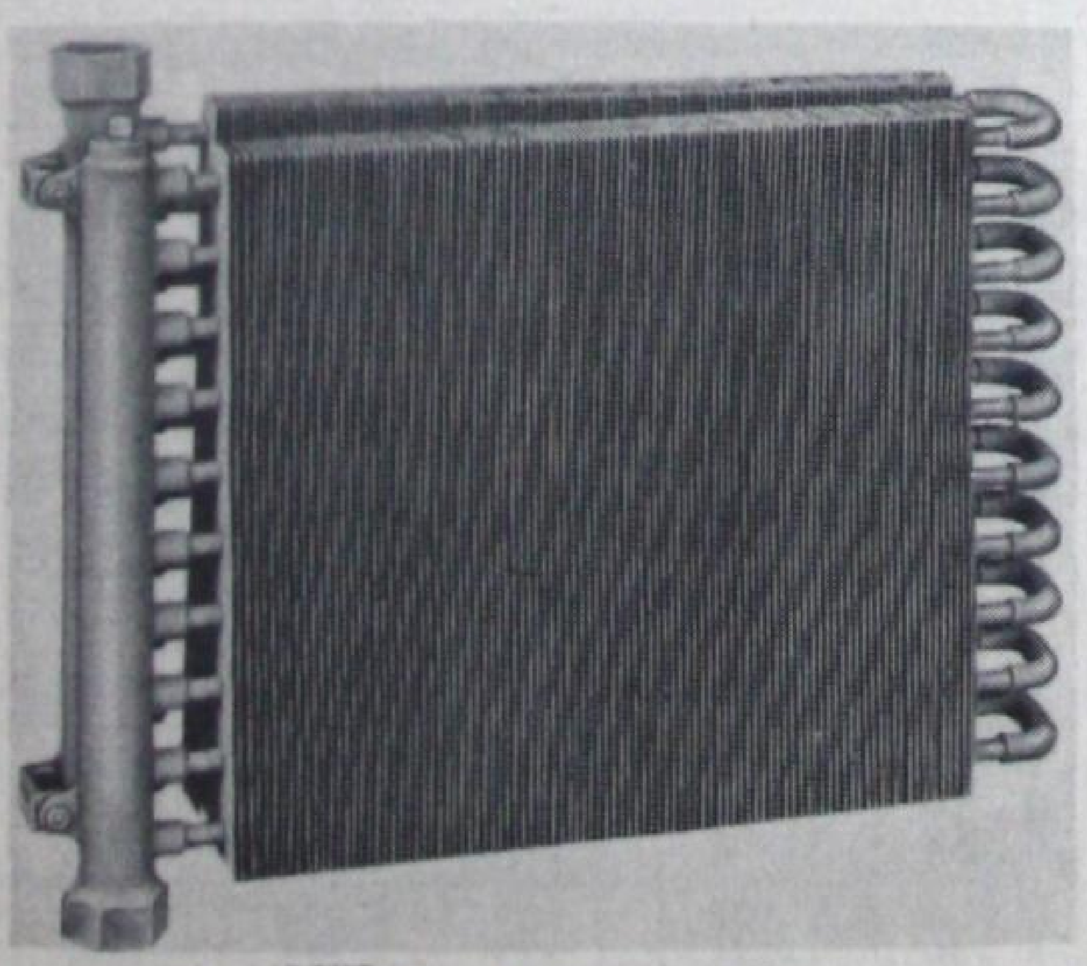
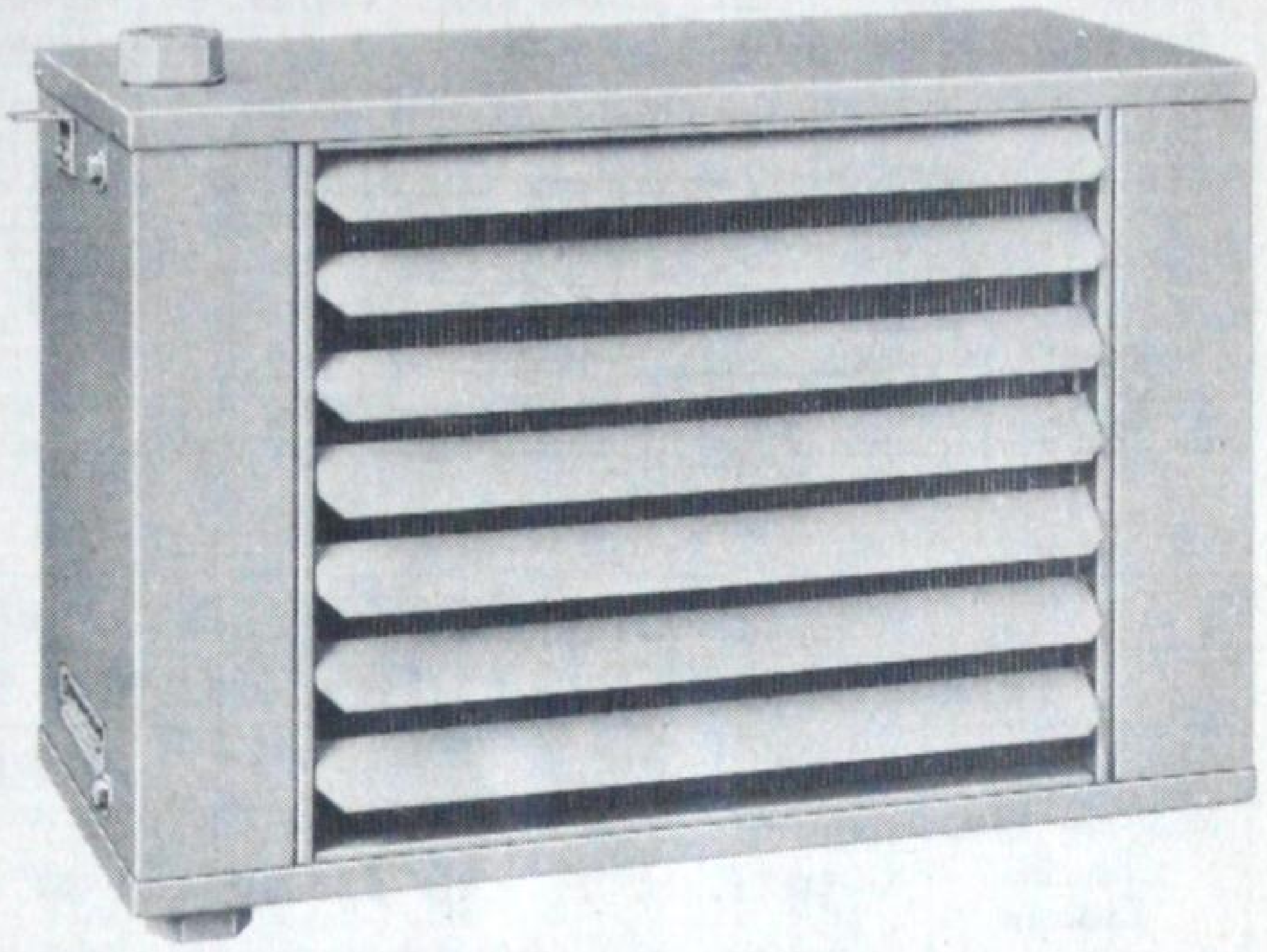


Fig. 3116A—Heating Element



Front View

Motors are fully enclosed and mounted on brackets. Rubber mountings provide for isolation of motor hum and vibration. Carefully balanced propeller type fans of high air capacity are mounted directly to motor shafts.

HEATING ELEMENTS

The heating element is constructed entirely of non-ferrous materials. Finned, round, seamless copper tubes of return bend type are welded to bronze supply and return headers.

Tubes are graded downwards from supply to return headers providing free drainage and eliminating any accumulation of air and condensation that might cause water hammer and its consequent noise and strain.

Fins have accurately formed collars making a positive and permanent bond between them and tube, ensuring maximum heat output for the life of the unit.

The heating elements are suitable for working pressures up to 125 P.S.I. and are tested at 400 pounds hydrostatic pressure.

CAPACITY DATA — 25 AND 60 CYCLE UNITS

CAPACITIES—TYPE VF UNITS AT 2 P.S.I. STEAM AND 60° F. ENTERING AIR

Unit Number and EDR at Normal Speed	HIGH SPEED UNITS Btu per Hour	cfm at 70°F.	Condensation Lbs. per Hour	Final Temp. Outlet Air °F.	Outlet Velocity (fpm)	Unit Number and EDR at Normal Speed	LOW SPEED UNITS Btu per Hour	cfm at 70°F.	Condensation Lbs. per Hour	Final Temp. Outlet Air °F.	Outlet Velocity (fpm)
125H	30000	454	31.0	121.0	615	....	....	....	....	....	.....
200H	48000	735	49.6	120.0	635	150L	36000	510	37.2	125.0	330
300H	72000	1145	74.4	117.0	675	200L	48000	630	49.6	130.4	340
400H	96000	1530	99.3	117.5	665	300L	72000	1000	74.4	126.4	445
600H	144000	2300	148.9	117.5	675	475L	114000	1560	117.1	128.5	468
800H	192000	3060	198.6	117.5	670	600L	144000	1980	148.9	128.6	440
1000H	240000	3930	248.2	116.5	690	800L	192000	2760	198.6	123.4	487

CONSTANTS TO DETERMINE CAPACITIES OF TYPE VF UNITS FOR CONDITIONS OTHER THAN 2 P.S.I. STEAM AND 60° F. ENTERING AIR

Steam Pressure Lbs. Sq. In. Gauge	ENTERING AIR TEMPERATURE −10° F.	0° F.	10° F.	20° F.	30° F.	40° F.	50° F.	60° F.	70° F.	80° F.	90° F.	100° F.
0	1.538	1.446	1.369	1.273	1.191	1.110	1.034	0.956	0.881	0.809	0.739	0.671
2	1.585	1.495	1.405	1.320	1.237	1.155	1.078	1.000	0.926	0.853	0.782	0.713
5	1.640	1.550	1.456	1.370	1.289	1.206	1.127	1.050	0.974	0.901	0.829	0.760
10	1.730	1.639	1.545	1.460	1.375	1.290	1.211	1.131	1.056	0.982	0.908	0.838
20	1.861	1.769	1.675	1.584	1.498	1.416	1.333	1.251	1.174	1.097	1.024	0.952
30	1.966	1.871	1.775	1.684	1.597	1.509	1.429	1.346	1.266	1.190	1.115	1.042

CAPACITIES—TYPE VFM UNITS AT 30 P.S.I. STEAM AND 60° F. ENTERING AIR

Unit Number and EDR at Normal Speed	HIGH SPEED UNITS Btu per Hour	cfm at 70°F.	Condensation Lbs. per Hour	Final Temp. Outlet Air °F.	Outlet Velocity (fpm)	Unit Number and EDR at Normal Speed	LOW SPEED UNITS Btu per Hour	cfm at 70°F.	Condensation Lbs. per Hour	Final Temp. Outlet Air °F.	Outlet Velocity (fpm)
129HM	30960	454	33.5	122.8	617	......	....	....	....	....	......
204HM	48960	735	52.7	123.6	637	153LM	36720	510	39.6	126.4	340
307HM	73680	1145	79.4	119.0	678	210LM	50400	630	54.3	133.8	375
409HM	98160	1530	105.8	119.0	670	306LM	73440	1000	79.0	128.7	445
615HM	147600	2300	159.0	119.0	680	480LM	115200	1560	124.0	129.8	470
817HM	196080	3060	211.2	119.0	670	620LM	148800	1980	160.3	129.0	442
1024HM	245760	3930	267.8	117.6	690	819LM	196560	2760	211.8	125.5	490

CONSTANTS TO DETERMINE CAPACITIES OF TYPE VFM UNITS FOR CONDITIONS OTHER THAN 30 P.S.I. STEAM AND 60° F. ENTERING AIR

Steam Pressure Lbs. Sq. In. Gauge	ENTERING AIR TEMPERATURE −10° F.	0° F.	10° F.	20° F.	30° F.	40° F.	50° F.	60° F.	70° F.	80° F.	90° F.	100° F.
10	1.285	1.217	1.147	1.084	1.021	0.958	0.899	0.840	0.784	0.729	0.674	0.622
20	1.382	1.314	1.244	1.177	1.112	1.052	0.990	0.929	0.872	0.815	0.760	0.707
30	1.460	1.323	1.318	1.251	1.186	1.121	1.061	1.000	0.940	0.884	0.828	0.775
40	1.529	1.455	1.385	1.316	1.250	1.186	1.122	1.062	1.002	0.944	0.888	0.831
50	1.585	1.511	1.450	1.370	1.304	1.237	1.175	1.112	1.051	0.994	0.938	0.882
60	1.631	1.555	1.496	1.413	1.345	1.281	1.218	1.152	1.094	1.035	0.976	0.920
70	1.676	1.602	1.541	1.457	1.390	1.324	1.260	1.193	1.133	1.074	1.015	0.960
80	1.717	1.642	1.582	1.500	1.430	1.364	1.298	1.231	1.171	1.111	1.052	0.998
100	1.789	1.714	1.651	1.566	1.651	1.431	1.364	1.295	1.234	1.175	1.117	1.058

CAPACITIES—MECHANICALLY CIRCULATED HOT WATER SYSTEM
APPLICATION—TYPE VFW UNITS AT 180° F. INLET WATER TEMP. AND 60° F. ENTERING AIR

Unit lumber and EDR at Iormal Speed	HIGH SPEED UNITS					Unit Number and EDR at Normal Speed	LOW SPEED UNITS				
	Btu per Hour	cfm at 70°F.	Outlet Air Temp. ° F.	*Min. U.S. Gals.	Friction Head Ins. W.G.		Btu per Hour	cfm at 70°F.	Outlet Air Temp. ° F.	*Min. U.S. Gals.	Friction Head Ins. W.G.
40HW	21000	454	102	2.1	0.5	....	....	....	....	......	....
22HW	33600	735	102	3.4	1.4	175LW	25200	510	106	2.5	0.8
36HW	50500	1145	101	5.0	1.8	222LW	33600	630	109	3.4	0.8
46HW	67000	1530	101	6.7	2.8	336LW	50500	1000	107	5.0	1.6
75HW	107000	2300	101	10.0	4.1	533LW	80000	1560	107	8.0	2.5
95HW	134500	3060	101	13.5	5.1	672LW	101000	1980	107	10.0	2.8
20HW	168000	3930	100	17.0	9.0	895LW	134500	2760	109	13.5	5.5

*Minimum U.S. Gals. at 20° F. Temp. drop to be circulated for Btu capacity stated.

CONSTANTS TO DETERMINE CAPACITIES OF TYPE VFW UNITS FOR CONDITIONS OTHER THAN 180° F. INLET WATER AND 60° F. ENTERING AIR

Entering Air Temp. ° F.	INLET WATER TEMPERATURE ° F.								
	140	150	160	170	180	190	200	210	220
50	0.74	0.84	0.93	1.00	1.08	1.17	1.25	1.33	1.40
60	0.66	0.75	0.84	0.93	1.00	1.08	1.17	1.25	1.33
70	0.58	0.66	0.75	0.84	0.98	0.98	1.08	1.17	1.25
80	0.50	0.58	0.66	0.75	0.84	0.93	1.00	1.08	1.17

To determine capacity at any water and air temperature other than shown in Hot Water System Capacity Table—multiply standard hot water capacities by constants in this table.

NOTES

DR (equivalent direct radiation), is expressed in square t, and all capacities have been determined in accordance th the codes of the American Society of Heating and ntilating Engineers. Steam application capacities are termined by dividing the Btu (British thermal units), tput by 240 and the hot water application Btu output 150.

pacities are based on recirculated air with free inlet d discharge as indicated in tables and with the steam essure or water temperature maintained at the inlet to heating element.

determine capacities for conditions other than noted standard tables multiply the capacities in the standard bles by the selected constants applying to that particular ndard table.

hen inlet air temperature is at or below freezing with am units, connections must be made to prevent any cumulation of condensation in the heating element. fety control devices are recommended to stop the fan en insufficient steam prevails in the unit. Hot water its should not be used where inlet air is likely to be at ezing or a lower temperature.

pe VFW Unit Heaters are recommended for mechanical- circulated hot water systems.

types are recommended for mounting heights of 12 t and less from floor.

FINAL AIR TEMPERATURE

Approximate outlet air temperatures may be determined for conditions other than stated in capacity tables by the following formula:

$$F.T. = T + \frac{Btu \times (460+T)}{cfm \times 564}$$

when

F.T. = Outlet air temperature.
T = Entering air temperature.
Btu = Btu per hour determined from capacity table values multiplied by constants for the particular conditions.
cfm = cfm indicated in the capacity table for the particular unit considered.

MULTI-SPEED UNITS

Only high speed, single phase, units can be furnished with multi-speed motors and suitable control switches which will provide approximate percentages of standard ratings as listed in the following table:

Speed	RPM	CFM	Btu
High	100%	100%	100%
Medium	80%	80%	89%
Low	60%	60%	77%

MOTOR DATA

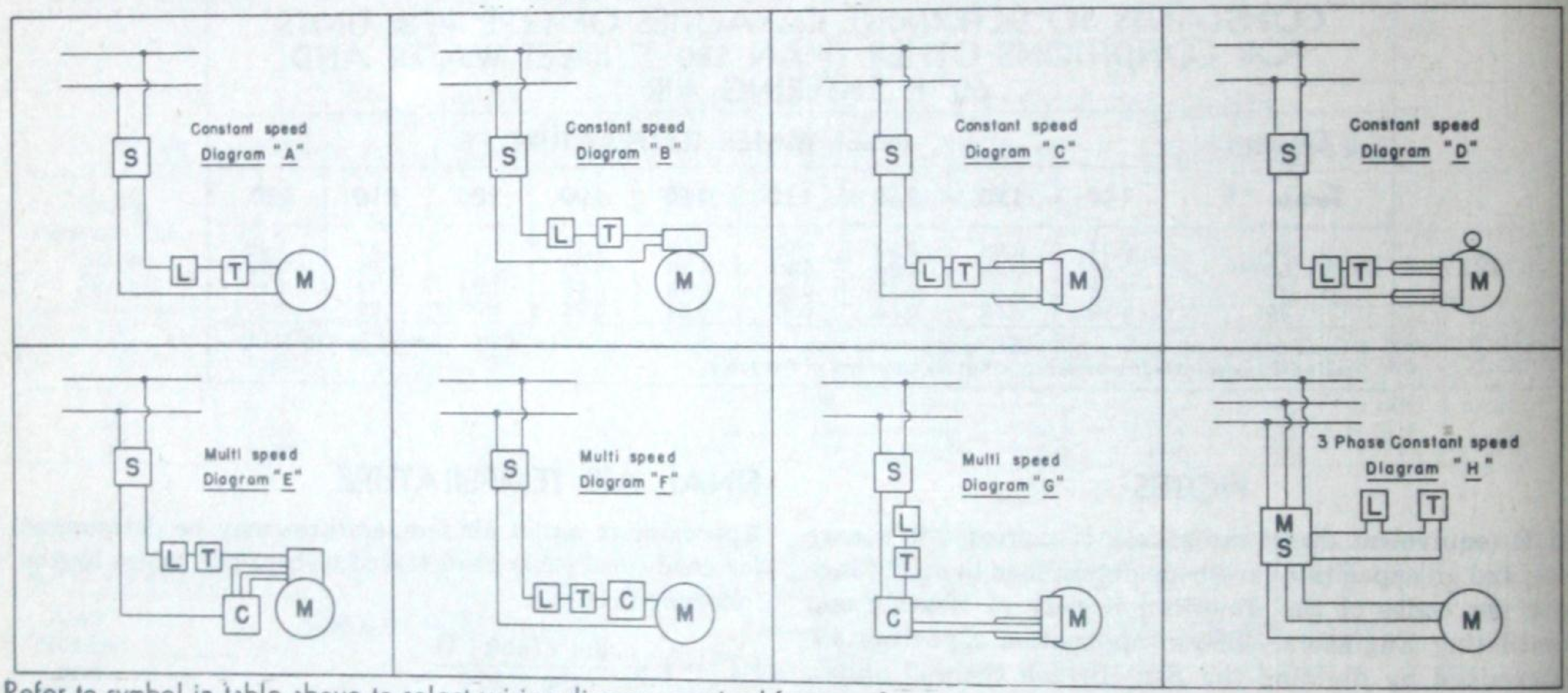
HIGH SPEED UNITS

Unit Number			25 CYCLE Motor H.P.	25 CYCLE R.P.M.	60 CYCLE Motor H.P.	60 CYCLE R.P.M.	Control Symbols Single Phase Wiring Diagram 1 Speed 25C	Control Symbols Single Phase Wiring Diagram 1 Speed 60C	Control Symbols Single Phase Wiring Diagram Multi Speed 25&60C
125H	129HM	140HW	1/100	1300	1/100	1620	A	A	F
200H	204HM	222HW	1/50	1300	1/50	1620	B	B	E
300H	307HM	336HW	1/10	1425	1/15	1150	C	C	G
400H	409HM	446HW	1/10	1425	1/15	1150	C	C	G
600H	615HM	675HW	1/4	1425	1/4	1150	C	C	G
800H	817HM	895HW	1/4	1425	1/4	1150	C	C	G
1000H	1024HM	1120HW	1/3	1425	1/4	1150	D	C	G

LOW SPEED UNITS

Unit Number			25 CYCLE Motor H.P.	25 CYCLE R.P.M.	60 CYCLE Motor H.P.	60 CYCLE R.P.M.	Control Symbols Single Phase Wiring Diagram 25 & 60C
150L	153LM	175LW	1/30	700	1/15	850	D
200L	210LM	222LW	1/30	700	1/15	850	D
300L	306LM	336LW	1/30	700	1/15	850	D
475L	480LM	533LW	1/8	700	1/15	850	D
600L	620LM	672LW	1/8	700	1/15	850	D
800L	813LM	895LW	1/8	700	1/15	850	D

TYPICAL WIRING DIAGRAMS


Constant speed Diagram "A"
S
L
T
M
Constant speed Diagram "B"
S
L
T
M
Constant speed Diagram "C"
S
L
T
M
Constant speed Diagram "D"
S
L
T
M
Multi speed Diagram "E"
S
L
T
C
M
Multi speed Diagram "F"
S
L
T
C
M
Multi speed Diagram "G"
S
L
T
C
M
3 Phase Constant speed Diagram "H"
MS
L
T
M

Refer to symbol in table above to select wiring diagram required for specific unit.

CONTROLS INDICATED IN DIAGRAMS ABOVE

S —Manual Starting Switch with overload protection.
L —Limit Switch.
T —Thermostat.
M —Motor.
C —Speed Control Switch.
MS—Magnetic Starter.

Starting switches or motor starters are not provided with single phase or polyphase units. Speed control switches are supplied only on order for multi-speed units.

MOTORS AND CONTROLS— Standard motors on all heaters are fully enclosed. Motors operate at normal speeds indicated in tables.

Only high speed, single phase units can be furnished with multi-speed motors and suitable speed control switches. Standard multi-speed units have 8 speed taps available and connected to the speed control switch. All speed controllers are intended for surface mounting remote from the unit, are not adaptable to flush mounting and should be located where their appearance will not be objectionable.

On single speed motors a starting switch equipped with thermal elements for overload protection should be used instead of fused switches.

The following makes are suggested: Canadian General Electric CR-1061, 2 pole single throw, ¾ H.P., 110 or 220 volts A.C.

Westinghouse Sentinel Breaker Type "H", 2 pole single throw, 1 H.P., 110 or 220 volts A.C.

Cutler-Hammer 9101, 2 pole single throw, 1 H.P., 110 or 220 volts A.C.

MAGNETIC CONTACTORS are necessary when the total connected motor load is greater than the capacity of the controlling thermostat. In such cases where the thermostat is controlling a group of units, the thermostat should actuate a magnetic contactor having a capacity at least equal to the total connected load. When motors are grouped on one contactor, each motor should have an individual manual starting switch with overload protection.

POLYPHASE motors can be supplied on order for all units equipped with 1/10 H.P. and larger motors for single speed operation only. Switches incorporating overload and phase failure protection are recommended.

DIMENSIONS

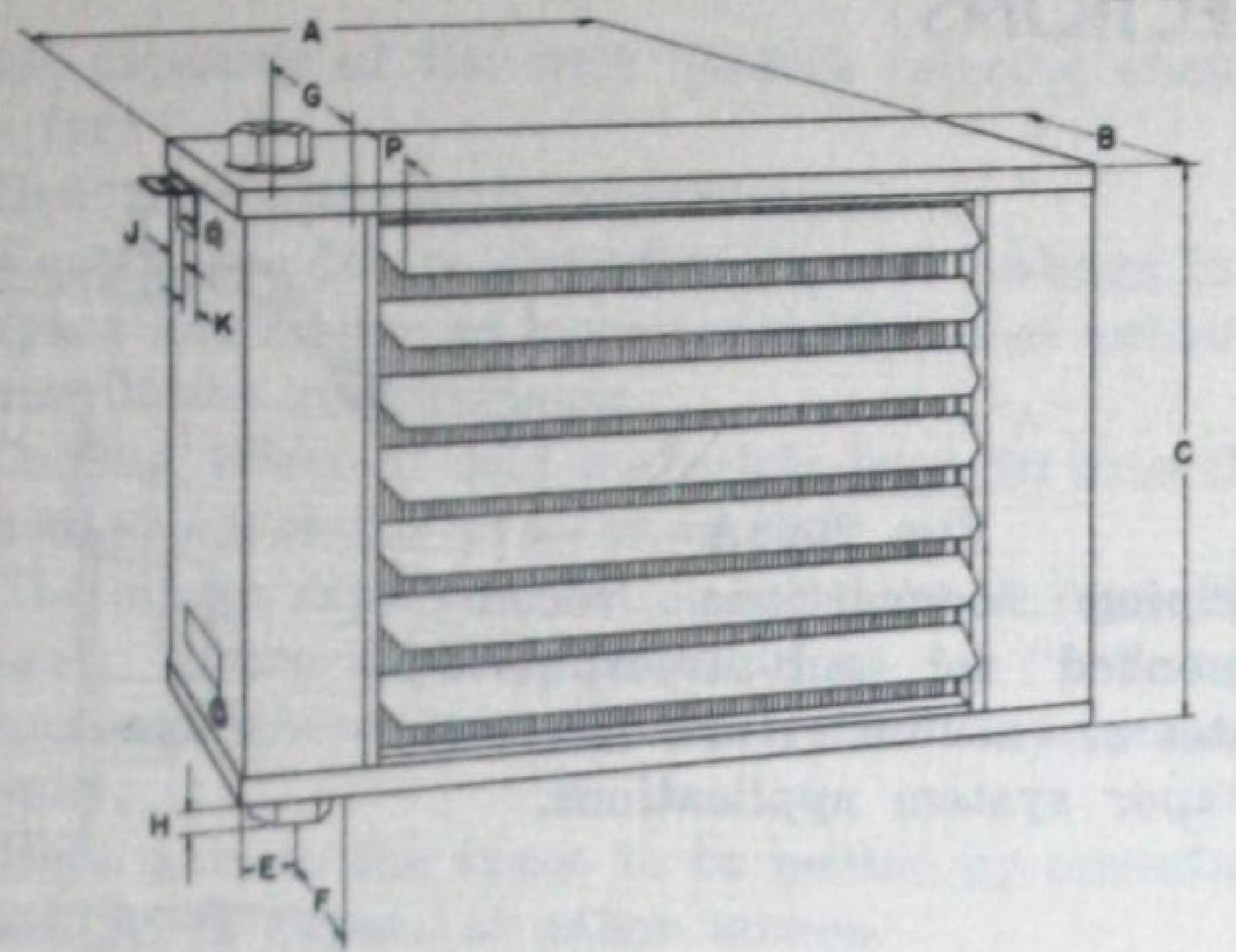


Fig. 3135

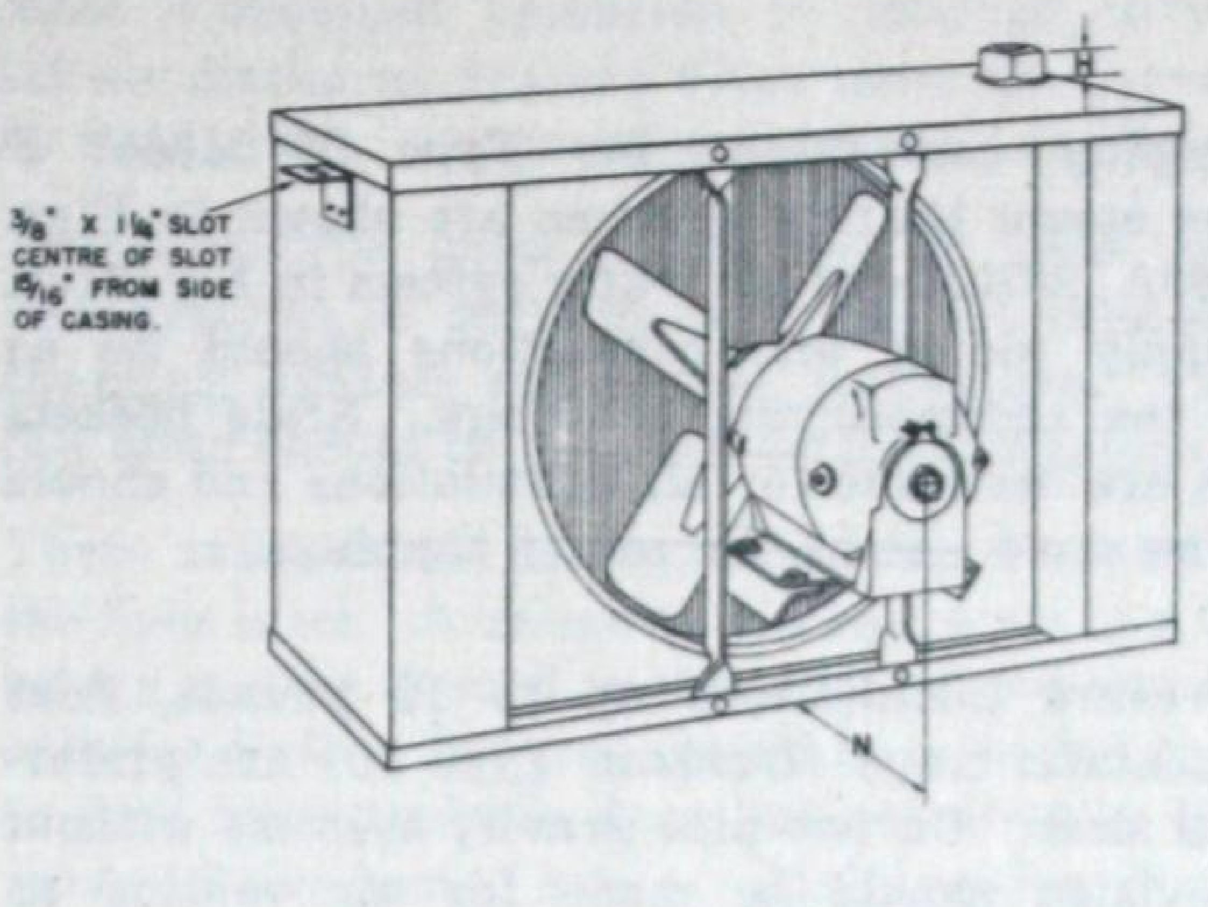


Fig. 3136

tandard supply tapping is out of top at left-hand de facing the front. Return tapping is out of bottom ; same side.

ll heaters are equipped with slotted hanger brackets ermitting adjustment of hanger rods at the balance point. Threaded ⅜" steel hanger rods are suitable for all sizes. These rods may be fastened to wood joists or inserts in concrete ceilings, or to steel beams. They are not furnished with unit.

TAPPINGS—DIMENSIONS AND WEIGHTS

UNIT NUMBERS						Tappings Supply and Return	DIMENSIONS INCHES											Approx. Shipping Weight Lbs.
HIGH SPEED			LOW SPEED				A	B	C	E	F	G	H	J	K	N*	P	
125H	129HM	140HW				1"	16½	10	11¾	1⅝	2	4¼	⅝	2	2	3	1	60
200H	204HM	222HW	150L	153LM	175LW	1¼"	20	10½	15⅛	1¾	2¼	4½	¾	2	2	3⅞	1	90
300H	307HM	336HW	200L	210LM	222LW	1¼"	25	12⅛	16⅞	2	2¼	4½	1	3½	2	8½	1	125
400H	409HM	446HW	300L	306LM	336LW	1¼"	29	13⅛	18⅝	2	2¼	4½	1	4	2	9	1	135
600H	615HM	675HW	475L	486LM	563LW	1½"	34¼	13⅛	22⅛	2⅛	2⅜	4⅝	1	4	2	9	1	165
800H	817HM	895HW	600L	620LM	672LW	2"	34¾	14⅛	29⅛	2¼	2½	4¾	1	4	2	10	1	200
1000H	1024HM	1120HW	800L	813LM	895LW	2"	41	14⅛	29⅛	2¼	2½	4¾	1	4	2	10	1	230

*N—Dimension varies slightly for motors of various characteristics.

OUTLETS AND ATTACHMENTS

TWO-WAY 60° OUTLET ASSEMBLY

Vhere it is desired to give a two-way air throw at 0° angles to the heater face, the two-way 60° outlet ssembly may be used. It is available on special order or the sizes of Type V Model F heaters shown in table elow. Construction embodies vertical splitters to uide the air stream and horizontal outlet louvres to ermit downward deflection.

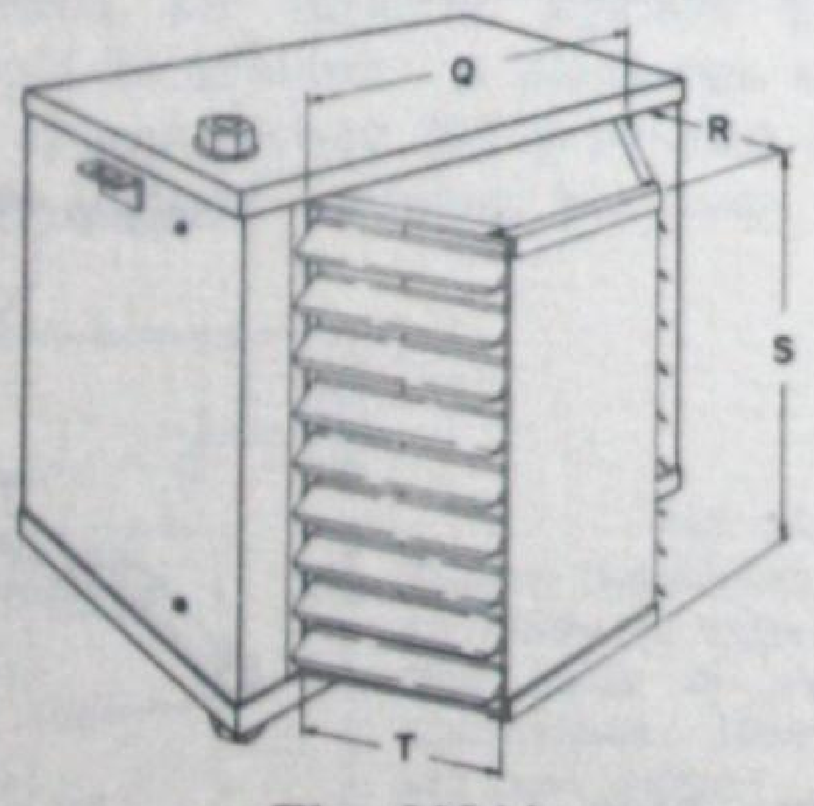


Fig. 2084A

UNIT NUMBERS						Two-Way Outlet Dimensions			
						Q	R	S	T
00H	204HM	222HW	150L	153LM	175LW	12⁹⁄₁₆	6¼	13	7½
00H	307HM	336HW	200L	210LM	222LW	16⁹⁄₁₆	7¼	14⅞	8½
00H	409HM	446HW	300L	306LM	336LW	20⁹⁄₁₆	8⅞	16⅝	10½
00H	615HM	675HW	475L	486LM	533LW	24¹¹⁄₁₆	11⅛	20⅛	13½
00H	817HM	895HW	600L	620LM	672LW	24¹¹⁄₁₆	11⅛	27	13½
00H	1042HM	1120HW	800L	813LM	895LW	31⅛	13¾	27	16

VERTICAL LOUVRE ASSEMBLY

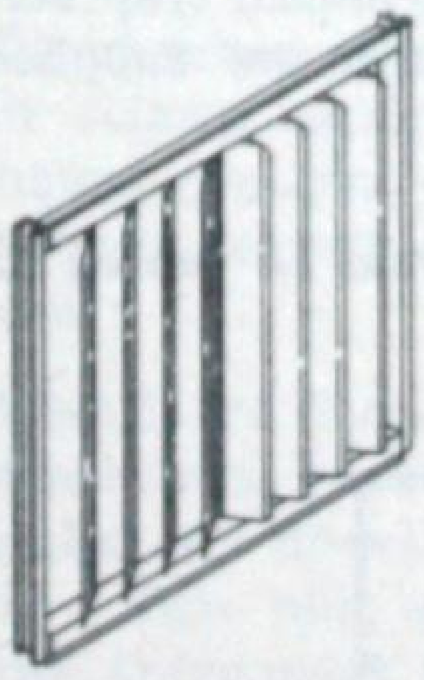


Fig. 2085A

Where it is desired to give sideways direction to the outlet air, the Vertical Louvre Assembly can be substituted for the standard Horizontal Assembly on special order for sizes shown in table below.

HORIZONTAL AND VERTICAL LOUVRE ASSEMBLY

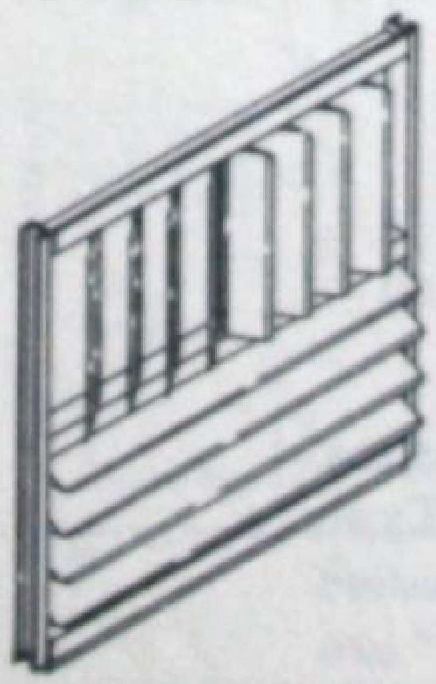


Fig. 2086A

For air direction sideways and downward this three-way assembly of louvres is available in place of standard louvres on special order for sizes shown in table below.

PIPING CONNECTIONS

Typical piping connections for Type V Model F Heaters on steam heating systems are shown in Figs. 2068A, 2069A, 2070A and hot water system in Fig. 3138. Steam supply piping and connections should be as shown on the accompanying drawings. Scale pockets on returns are desirable for all installations and should be made the same size as the return tappings.

On low-presure installations up to 15 pounds, float and thermostatic traps (Dunham Type 30) are preferable for all sizes. On two-pipe gravity systems without traps, provision should be made for air venting as shown in Fig. 2069A.

On medium-pressure installations up to 60 pounds, connections should be made substantially in accord with Fig. 2068A except that Dunham medium pressure traps are to be used.

On high-pressure installations up to 125 pounds, inverted open bucket traps (Dunham Type 81A) should be applied as shown in Fig. 2070A.

Where condensate must be elevated to a higher return line, inverted open bucket traps must be used.

Dripping of steam lines through heaters is to be avoided wherever possible. When it must be done, pipe sizes and trap capacities must be increased to handle the additional load.

Strainers are recommended ahead of all traps and will more than repay their cost in lengthened trap service. No pipe, fittings, valves or traps are supplied with Type V Model F Heaters.

On hot water installations, piping should be vented as shown on Fig. 3138.

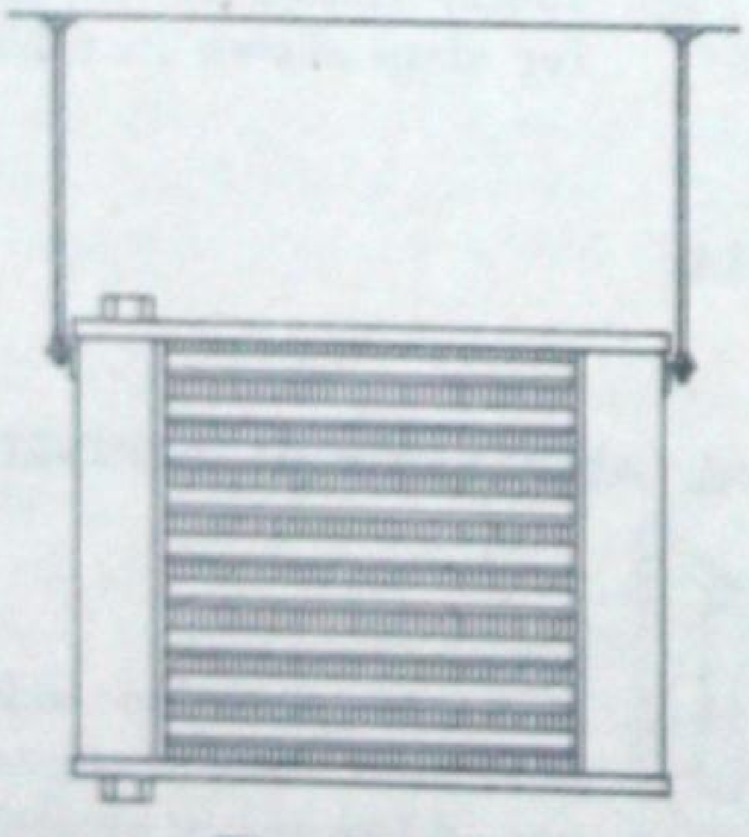


Fig. 2081A
Simple two-point hanging arrangement used with Type V Model F Heaters. Threaded steel hanger rods (⅜″) are fastened to the hanger brackets by steel nuts. To be furnished by Contractor.

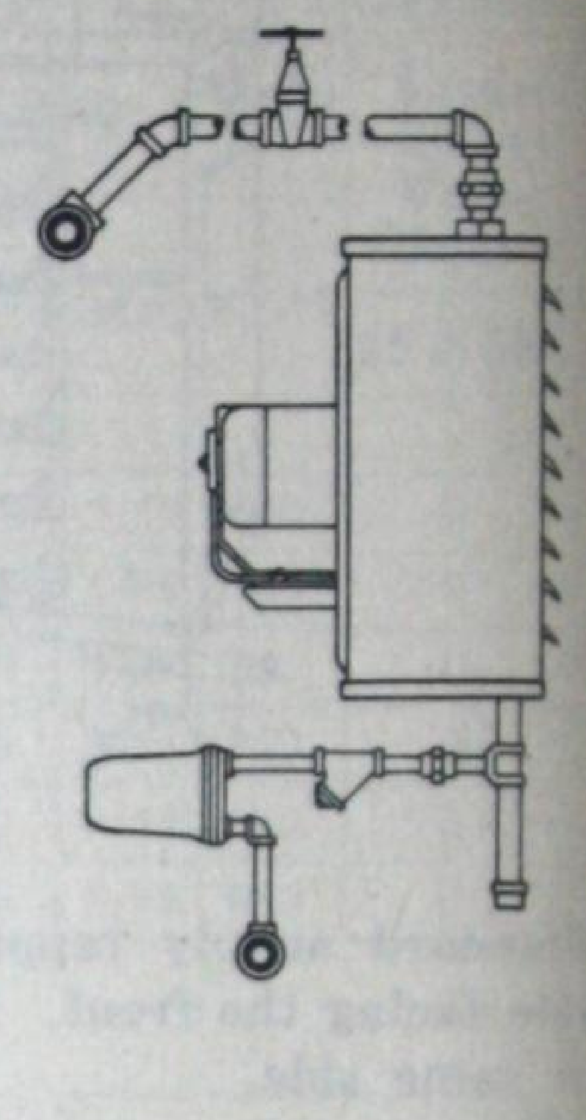


Fig. 2068A
Piping connections recommended for sub-atmospheric steam, vacuum return line, or vapor system applications.

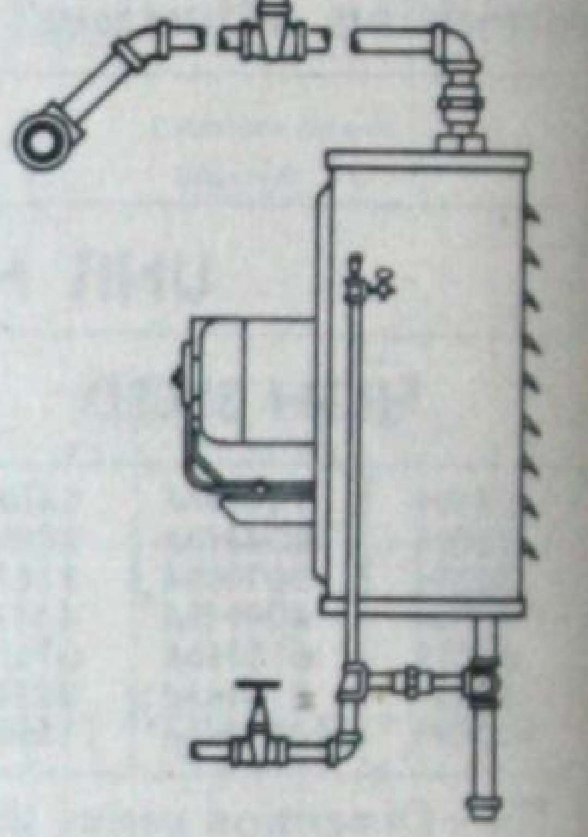


Fig. 2069A
Piping connections recommended for two-pipe gravity steam systems without traps.

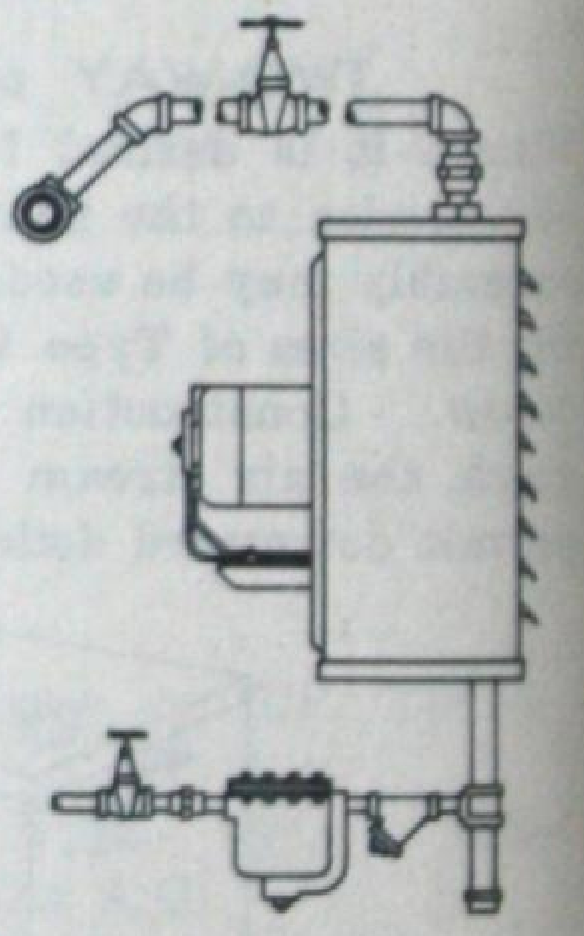


Fig. 2070A
Piping connections recommended for high-pressure steam system applications.

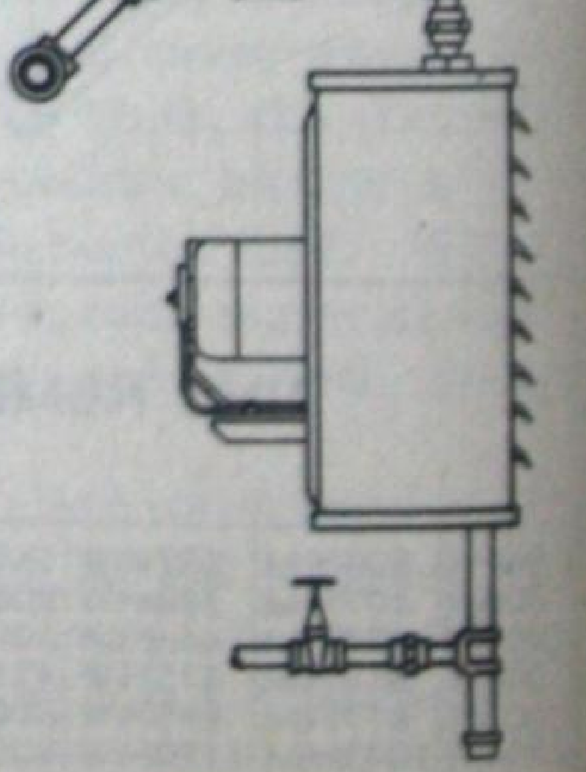


Fig. 3138
Piping connections recommended for hot water system application.

SELECTING AND APPLYING UNIT HEATERS

ıe total capacity of the unit heaters selected should ovide for:

(a) Heat losses through construction.
(b) Heat losses due to air infiltration or leakage into space heated due to loose construction or exhaust ventilation requirements.
(c) Cooling effect of cold materials brought into the heated space for processing.
(d) The steam supply condition-constant-or intermittent. Extra capacity is required for "pick up" heating where intermittent steam supply prevails.
(e) Heat gain to the space to be heated by manufacturing processes or other means.
(f) Where unit heater load is the total load on a heating system boiler, it is preferable that individual units do not exceed 25% of total boiler load, especially if they are thermostatically controlled. This will minimize boiler load fluctuations.

SELECTION OF TYPE

The type of unit selected should be determined by:

(a) Type of occupancy and nature of processes carried on in space heated.
(b) The height of installation of unit.
(c) Number of units permissible.
(d) Relation of air discharge capacity to volume of space to be heated.
(e) The noise level permitted for the location.

'he following generalizations are useful in unit eater applications:

'nits providing large air volume at relatively low emperatures (below 130° F.) assure more uniform oor-to-ceiling temperatures than units having low olume and high temperature air discharge.

enerally, the units should be located so the air disarge from each induces rotation of the entire air in e room so as to promote diffusion.

nit heaters should be located so that a large percentge of the air is discharged toward the side of the buildg affected most by prevailing winds.

lowing heated air directly against exposed cold rfaces should be avoided. A discharge air stream at angle of approximately 30° providing a wiping acon over the exposed surfaces, has been found satisctory.

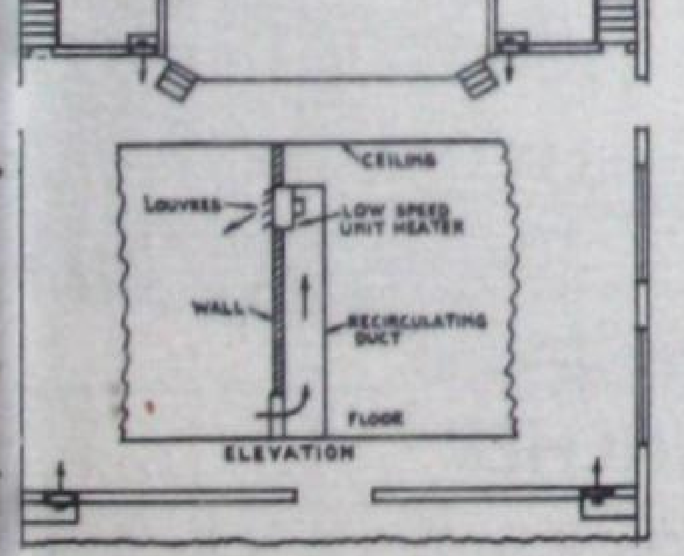


Fig. 3139
Typical installation of horizontal air discharge units with circulation ducts in gymnasium or auditoriums. Slow speed units are best suited.

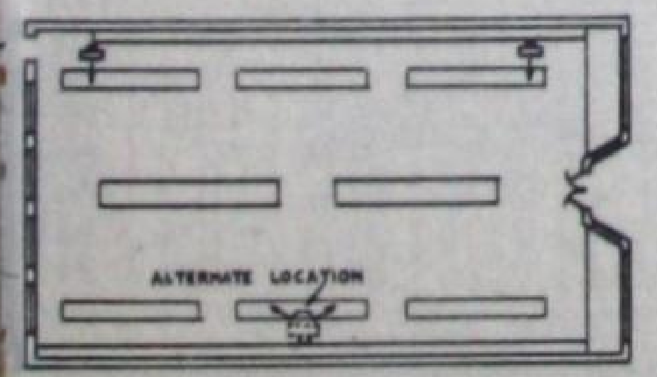


Fig. 3140
Typical installation of horizontal air discharge unit heaters in retail store. Low speed units are best suited.

Most economical operation is obtained with horizontal air discharge heaters when these are located as low as head room, occupancy and piping conditions permit.

Propeller type units should not be used with extensive systems of ducts as fans are not suitable for discharging against substantial resistances. Centrifugal fan units should be used for such applications.

These units should be installed from 7' 6" to 12" above the floor level. Arrange to discharge air in a horizontal rotary motion around space to be heated and across the exterior walls. Louvres should be adjusted to direct air to flow down towards floor but not directly on to occupants of the heated space. Air direction should be arranged to avoid obstructions or so directed that the obstruction assists in the diffusion of the air discharged. Where large areas are broken up by elevators or smaller rooms projecting into the larger area, it is desirable for a heater to be provided for each space or bay formed. Unit spacing should be in relation to air discharge velocity.

APPLICATION OF PROPELLER TYPE HORIZONTAL AIR DISCHARGE UNITS

Offices, retail stores, show rooms, etc., should generally be made with duct work to draw air from the floor and to operate at the lower motor speeds. Where workers are at benches around or near windows, radiation should be applied under windows and unit heaters used as supplementary heating usually thermostatically controlled.

Where ceiling expanse is small in relation to the interior wall area, unit heaters may be arranged to project air discharge towards exterior walls—to force cooler air to remain adjacent to the walls.

The number of units should be such that their total air volume capacity per hour would be four times the cubical contents of the space heated and so arranged that the heating effects of the units would overlap each other.

When large doors are frequently opened, a larger supplementary heater should be arranged to discharge heated air directly from above towards the incoming air. This unit should be under thermostatic control with thermostat set a few degrees below normally desired temperature.

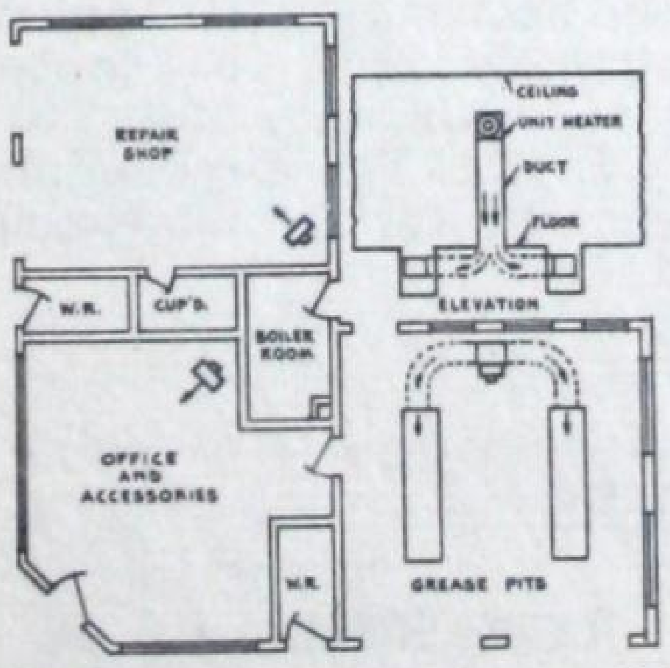


Fig. 3141
Typical installation of horizontal air discharge units applied to service garages. NOTE: Unit discharging to grease pits. This same arrangement would apply where car hoists are used. The heated air assists in thawing out and drying car chassis.

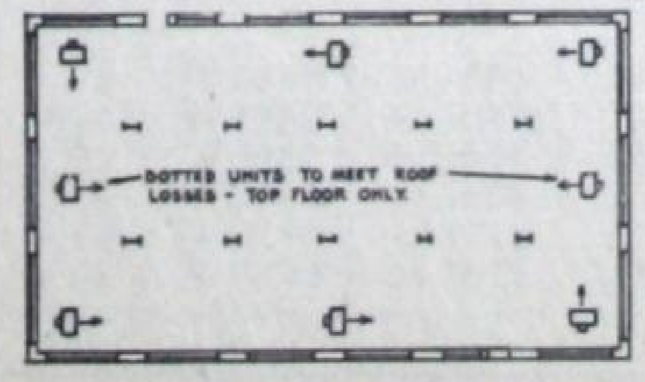


Fig. 3142
Typical installation of horizontal air discharge unit heaters on factory floor providing rotary air motion around walls.

RECIRCULATING DUCTS AND EXTENDED STEEL STRIPS

Recirculating ducts are recommended for many installations of unit heaters of horizontal air discharge type. By drawing in the cooler air from the floor line, they accelerate the natural gravity displacement by reducing the temperature difference between floor and ceiling levels. They are not recommended for use in vestibules or near shipping room or other doors frequently opened.

The Dunham Company does not furnish these ducts because usually they can be constructed on the job to better advantage at a saving to the owner on first cost. Dimensions of recirculating ducts are listed to assist Contractors in fabrication. Where quietness is essential, ducts may be built of wood framing covered with wallboard or with insulating fibre board.

While the resistance of a recirculating duct reduces slightly the capacity of a unit heater, the increased heating efficiency more than offsets the decreased capacity. No increase in heater size need be figured for recirculating ducts of the dimensions tabulated.

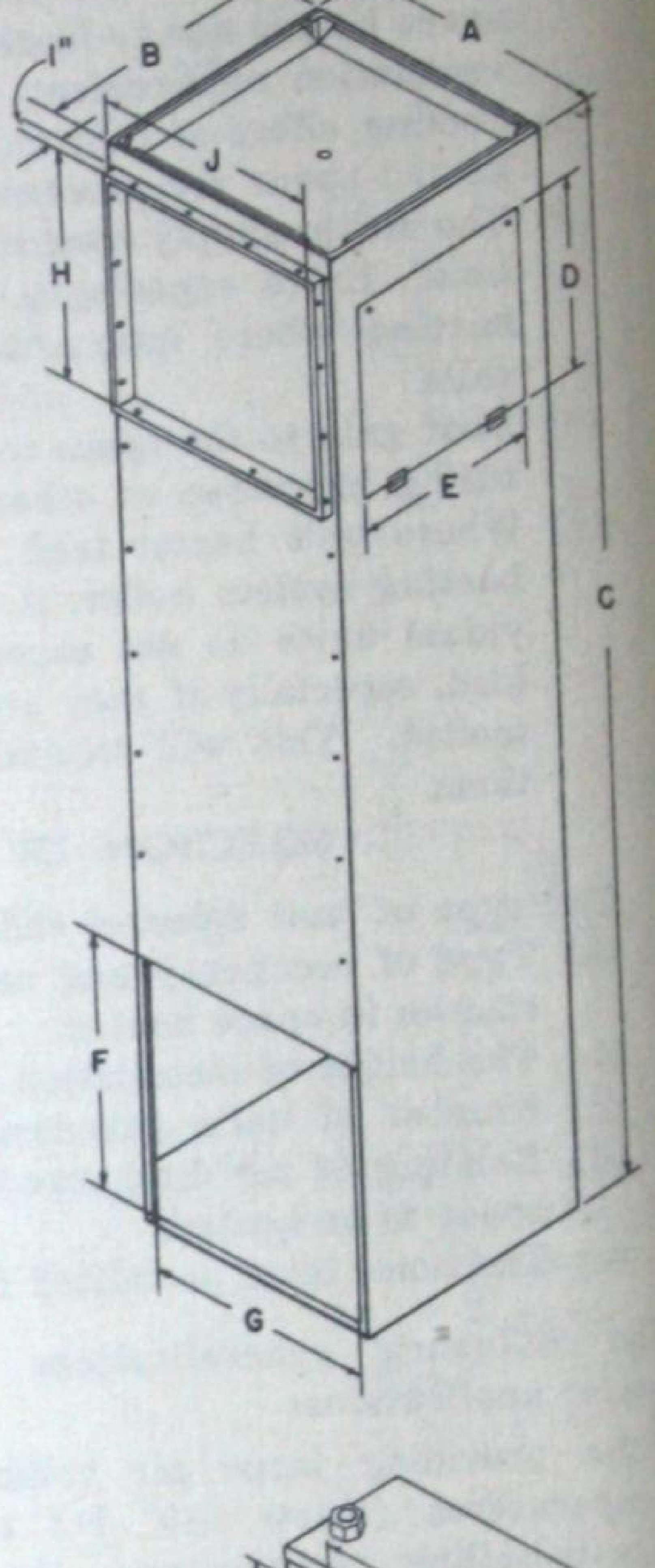


Fig. 2088A
Recirculating Duct

EXTENDED STEEL STRIPS

When so ordered, unit heaters will be furnished with an extended steel strip either at the back or front, drilled with ⅛" holes at 3" centres for fastening either to the duct or to a canvas connection. When this duct connection is ordered for the front of the heater, louvres are not supplied unless specified on order.

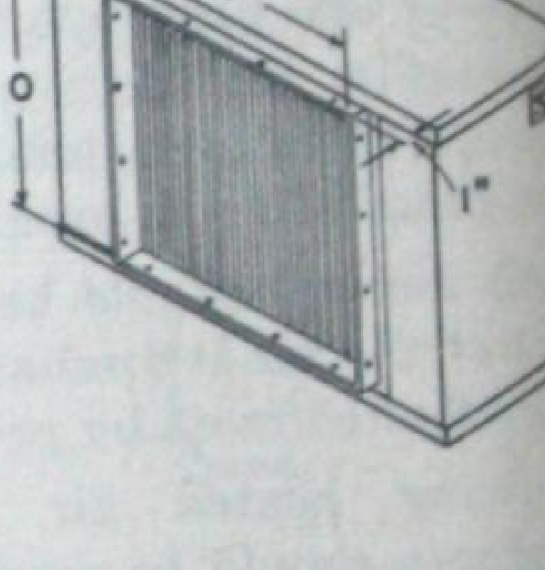


Fig. 3143
Extended Steel Strip on Outlet

DUCT WORK — OUTSIDE AIR

The propeller type fans used in Type V Model F Heaters are not designed to move air against any substantial resistance. Duct work, therefore, (other than recirculating ducts of standard dimensions) should be used only to meet special conditions such as the bringing in of outside air, or the location of heaters in unfinished space to discharge into finished rooms. Where outside air at less than freezing temperature may be brought to the heaters, care should be taken to see that piping connections are not carried through inlet ducts and permit complete drainage of the heater by gravity. Also a safety control should be provided to stop fan operation and prevent cold drafts whenever there is insufficient steam in the heating element. Dunham Engineers will gladly make specific recommendations for such applications.

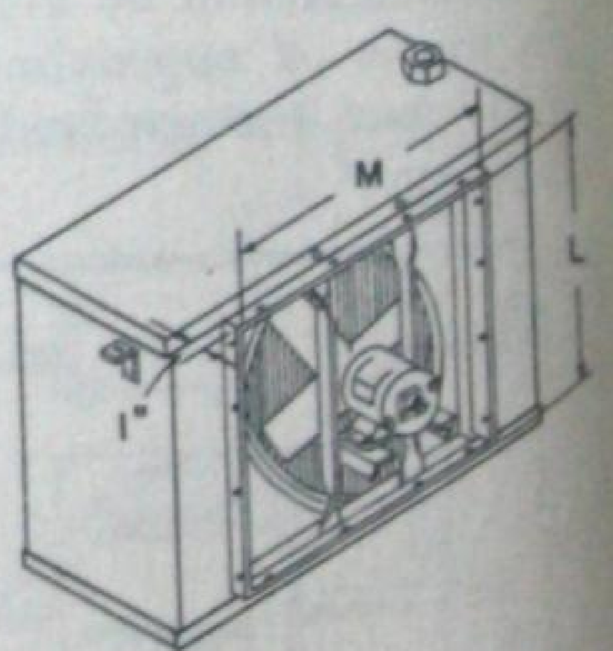


Fig. 3144
Extended Steel Strip on Inlet

In no cases should the ducts be of less area than the face area of the heaters and in all cases they should be as short and straight as possible. A total resistance through the ducts and connections of .05" of water gauge pressure is the maximum which can be recommended for this type of heater. The use of close mesh grilles or filters is thus not practical. A friction loss of .05" water gauge reduces the heat output of Type V Model F Heaters by approximately 15%; .03" water gauge reduces the output by approximately 10%; .01" water gauge by approximately 3½%. These reductions in capacity should be compensated for by increasing capacities of heaters selected.

UNIT NUMBERS						DIMENSIONS IN INCHES											
HIGH SPEED			LOW SPEED			A	B	C	D & E	F	G	H	J	L	M	O	P
125H	129HM	140HW				13½	12⅛	92	8	16	12	9¾	11¾	9¾	11¾	10	10⅝
200H	204HM	222HW	150L	153LM	175LW	17	13⅞	96	9¾	18	15½	13⅛	15¼	13⅛	15¼	13⅜	12½
300H	307HM	336HW	200L	210LM	222LW	19⅜	18⅛	99¼	14	22¾	17⅞	15	17⅝	15	17⅝	15¼	16½
400H	409HM	446HW	300L	306LM	336LW	22⅞	20⅛	101¼	16	28¾	21⅜	16¾	21⅛	16¾	21⅛	17	20⅛
600H	615HM	675HW	475L	486LM	533LW	27½	23⅛	104¾	19	34⅝	26	20¼	25¾	20¼	25¾	20½	24⅝
800H	817HM	895HW	600L	620LM	672LW	27½	26⅛	111¾	19	34⅝	26	27⅛	25¾	27⅛	25¾	27⅜	24⅝
1000H	1024HM	1120HW	800L	813LM	895LW	33⅛	27⅛	111¾	19	39⅛	32⅜	27⅛	32⅛	27⅛	32⅛	27⅜	31

DUNHAM TYPE C - A 'DOWNFLO' UNIT HEATER

The "Downflo" Heater is designed for industrial and commercial applications where it is desired to drive the heated air stream more directly floorwards than is possible with horizontal air discharge heaters.

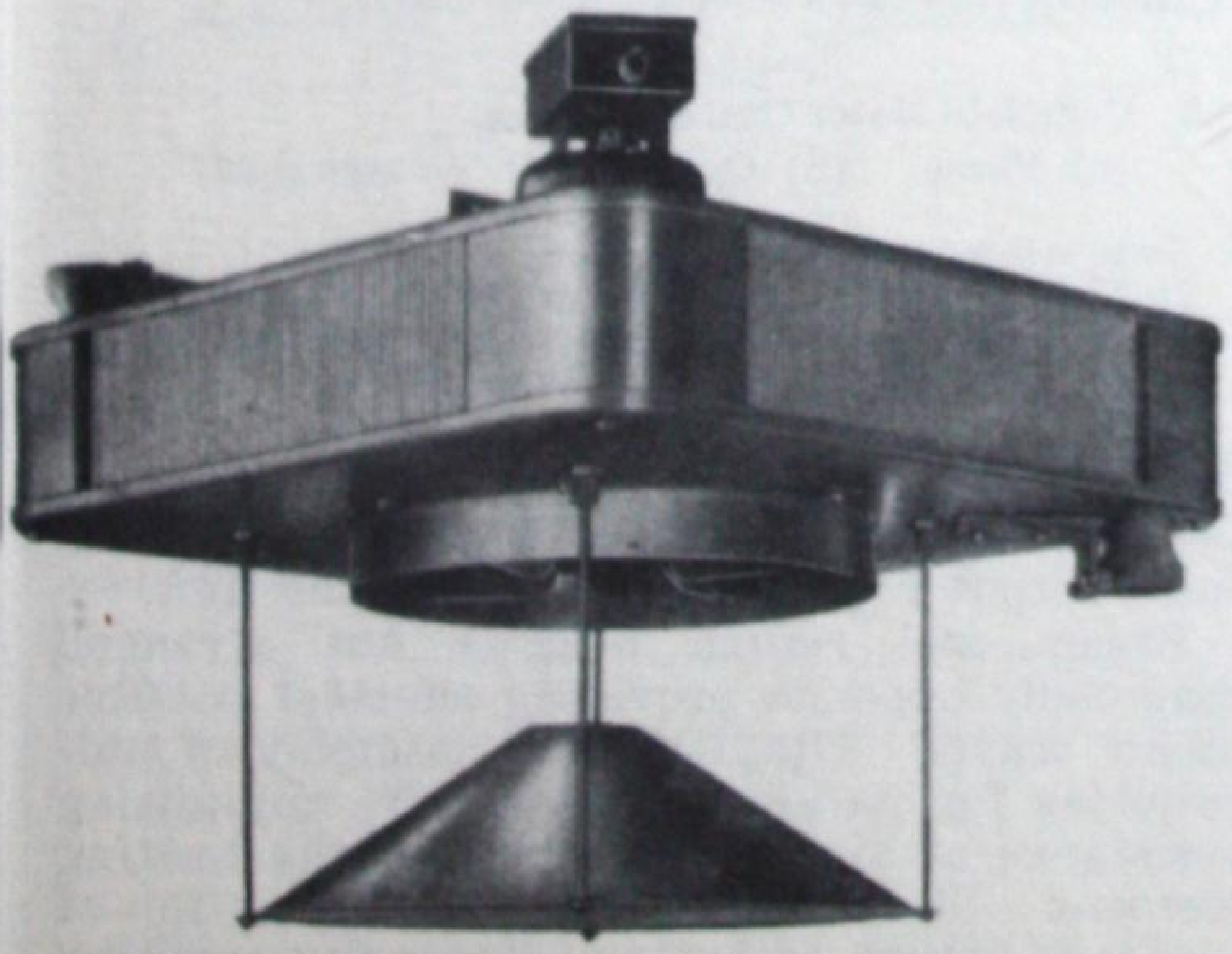
High ceilings in factories, high clearances necessary for industrial equipment such as cranes and over-doorway heat requirements of stores and office buildings, are typical of the conditions which this heater is best adapted to meet.

The "Downflo" Heater is in no sense a conventional unit heater upended. It is designed throughout for its specialized function of driving a large volume of heated air at relatively high velocity and low temperature down to working levels.

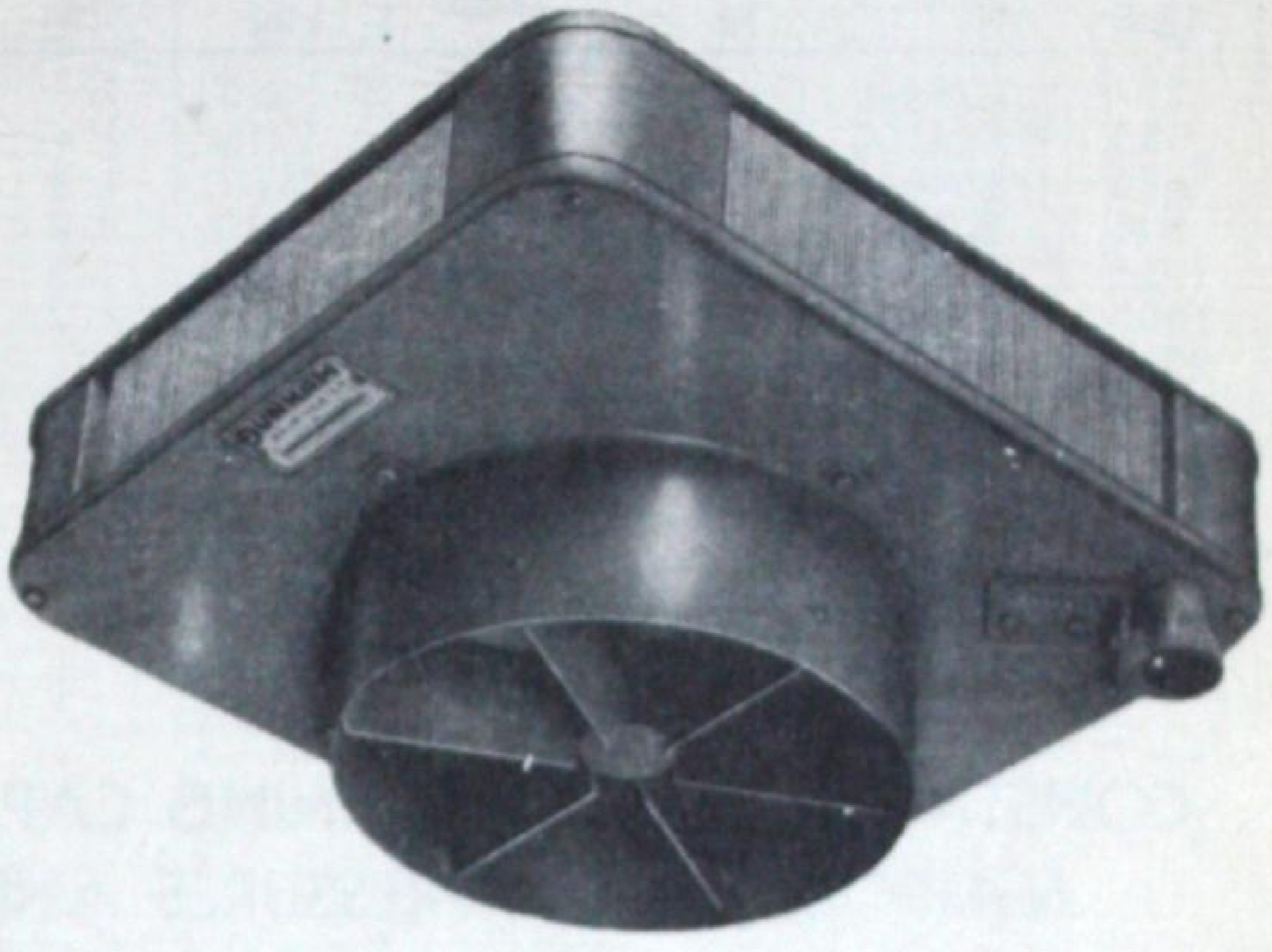
AIR DISCHARGE ASSEMBLIES

Adjustment of the movable Radial Louvres provides for the discharge air stream to be changed from a narrow and nearly vertical discharge for high mounting heights to an oblique and broadened air discharge for lower mounting heights.

The Cone Assembly as shown, may be supplied when so ordered at no extra cost in place of standard Air Discharge Assembly with Radial Louvres. This will provide a hollow, cone shaped air stream, and the closer the cone is adjusted to the air outlet, the more nearly horizontal will be the air discharge stream. This assembly is recommended where comparatively low ceilings prevail or sedentary workers are stationed immediately under the heaters.



Type C-A Unit Heater with Cone Assembly



Type C-A Unit Heater with Standard Air Discharge Assembly with Radial Louvres

HEATER CASING

The Heater Casing is rigidly assembled from furniture steel sheets, braced and welded where necessary to ensure freedom from vibration. The whole casing, heating element and motor are assembled to substantial angle iron frame to which suspension hangers are to be attached. The whole forms a compact and serviceable unit. Inlet air is drawn into the heating element through each side of unit.

MOTORS

Motors are 1425 R.P.M. for 25 cycle units, 1140 R.P.M. for 60 cycle units. Single phase motors are of condenser type, totally enclosed, with grease-sealed ball bearings and welded rotors. They are carried in stock for 110 volts. Polyphase motors are likewise totally enclosed, with grease-sealed ball bearings and welded rotors. These motors are not carried in stock.

Motor, air guide and fan assembly may be removed through discharge air opening, without disturbance of unit suspension or piping connections. Motor lubrication is by two compression lubricating cups accessible at top of unit. Multi speed motor controllers can be provided but special consideration should be given to their application since reduction of fan speed reduces amount of air handled by unit and therefore discharge velocity and in consequence, reduces the distance and the area over which the air may be satisfactorily distributed.

FANS

Fans are constructed for maximum capacity at minimum current consumption. Fans are balanced and blades designed for quiet air delivery. Hubs are keyed to shouldered motor shaft threaded at end with lock nuts.

PERFORMANCE DATA

Capacities are Based on Steam at 2 lbs. Gauge, 60°F. Entering Air

25 CYCLE—1425 R.P.M.—60 CYCLE—1140 R.P.M.									
Unit No. and EDR	B.T.U. per hour	C.F.M. at 70° F.	Final Temp.	Outlet Velo-city	Motor H.P.	MOUNTING DATA—DISCHARGE LOUVRES VERTICAL			Shipping Weight Lbs.
						MAX. MOUNTING HEIGHT—FEET	FLOOR SPREAD		
							Diam. Ft.	Area Sq. Ft.	
317	76080	1200	118.0	820	1/6	12	18–24	250–450	185
525	126000	2200	113.0	1515	1/4	18	30–35	700–950	210
686	164640	2900	112.0	1765	1/3	28	40–50	1200–2000	270
846	203040	3500	113.5	1830	1/3	30	55–60	2400–3000	300
1036	248640	4400	112.0	1900	1/2	30	60–70	3000–4000	370
1600	384000	6300	116.0	2160	1/2	35	65–75	3500–4500	560
2062	494880	8000	116.0	2200	1	35	75–90	4500–6500	760

Approximate performance in percentages of ratings shown in table above when using multi-speed controllers. Intermediate speed provide capacities between those for high and low speeds.

SPEED	R.P.M.	C.F.M.	B.T.U.
High	100%	100%	100%
Low	60%	60%	77%

CONSTANTS FOR DETERMINING CAPACITY OF TYPE C UNIT HEATERS FOR VARIOUS STEAM PRESSURES AND ENTERING AIR TEMPERATURES.*

Steam Pressure Lbs. Sq. In. Gauge	ENTERING AIR TEMPERATURE										
	-10°F	0°F	10°F	20°F	30°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F
0	1.483	1.405	1.329	1.253	1.178	1.105	1.032	0.962	0.892	0.822	0.754	0.688
2	1.520	1.442	1.363	1.290	1.215	1.141	1.069	**1.000**	0.930	0.861	0.792	0.728
5	1.565	1.485	1.410	1.334	1.260	1.187	1.114	1.045	0.975	0.906	0.838	0.771
10	1.637	1.558	1.480	1.403	1.328	1.253	1.182	1.112	1.042	0.973	0.903	0.838
15	1.688	1.610	1.533	1.458	1.382	1.310	1.239	1.168	1.099	1.028	0.960	0.895
20	1.728	1.649	1.572	1.498	1.421	1.350	1.278	1.208	1.138	1.070	1.002	0.936
30	1.803	1.725	1.648	1.572	1.497	1.423	1.352	1.281	1.212	1.145	1.078	1.010
40	1.864	1.787	1.710	1.637	1.563	1.491	1.420	1.350	1.282	1.215	1.148	1.081
50	1.927	1.850	1.773	1.700	1.628	1.554	1.483	1.416	1.347	1.278	1.211	1.145
60	1.973	1.987	1.820	1.748	1.673	1.601	1.531	1.463	1.394	1.325	1.260	1.194
70	2.018	1.943	1.869	1.795	1.722	1.651	1.582	1.512	1.443	1.377	1.310	1.243
75	2.043	1.970	1.895	1.822	1.750	1.680	1.609	1.540	1.471	1.402	1.333	1.268
80	2.064	1.988	1.914	1.841	1.770	1.698	1.629	1.560	1.491	1.422	1.354	1.288
90	2.102	2.028	1.951	1.878	1.804	1.732	1.661	1.590	1.523	1.457	1.387	1.321
100	2.150	2.071	1.994	1.919	1.845	1.770	1.700	1.630	1.560	1.492	1.425	1.359

NOTE: To determine capacity at any steam pressure and entering air temperature, multiply constant from this table by rated capacity at 2 lb. pressure and 60°F. entering air temperature.

*From A.S.H. and V.E. Guide.

ORDERING INFORMATION

To prevent misunderstandings and delays in filling orders, the following information should be given on all orders:

1. Billing Instructions.
2. Shipping Instructions.
3. The Unit No. and quantity of each size required.
4. Complete Motor Characteristics:
   (a) Phase (b) Cycle (c) Voltage (one)
5. State steam pressure conditions:
   If Unit Heater is required for other conditions than 2 lbs. gauge, a special element will be furnished to give the proper capacity and final temperature.

HEATING ELEMENTS

The Heating Element is constructed entirely of non-corrosive material to withstand a working steam pressure of 125 pounds gauge. Headers are of cast bronze, tubes of copper are welded into machined bosses of headers providing ample margin of strength and rigidity. Headers are of exceptionally large volume and tubes are orificed to ensure equal distribution of steam to each tube. Fins have accurately formed collars into which tubes are tightly fitted to form a permanent and positive bond between tube and fins, ensuring maximum heat output for the entire life of the unit.

Steam and return headers are arranged diagonally opposite providing shortest possible steam travel. The SQUARE assembly of unit provides for parallel fin assembly, minimizing resistance of air passage through the heating element. Steam tapping is provided at top of unit and return at bottom diagonally opposite. Heating Elements are hydrostatically tested to a water pressure of 300 pounds.

DIMENSIONS OF UNIT HEATER AND AIR DISCHARGE ASSEMBLIES

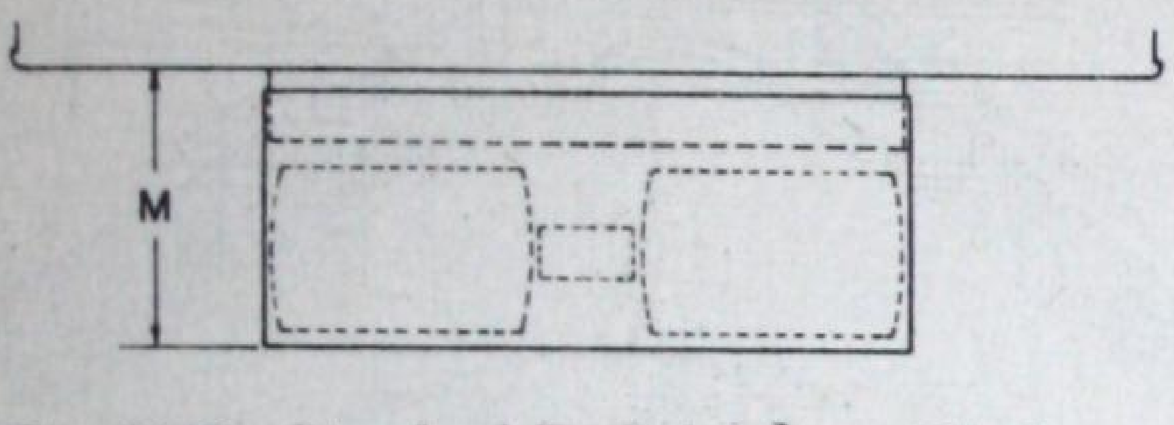


Fig. 3149—Standard Radial Louvre Discharge

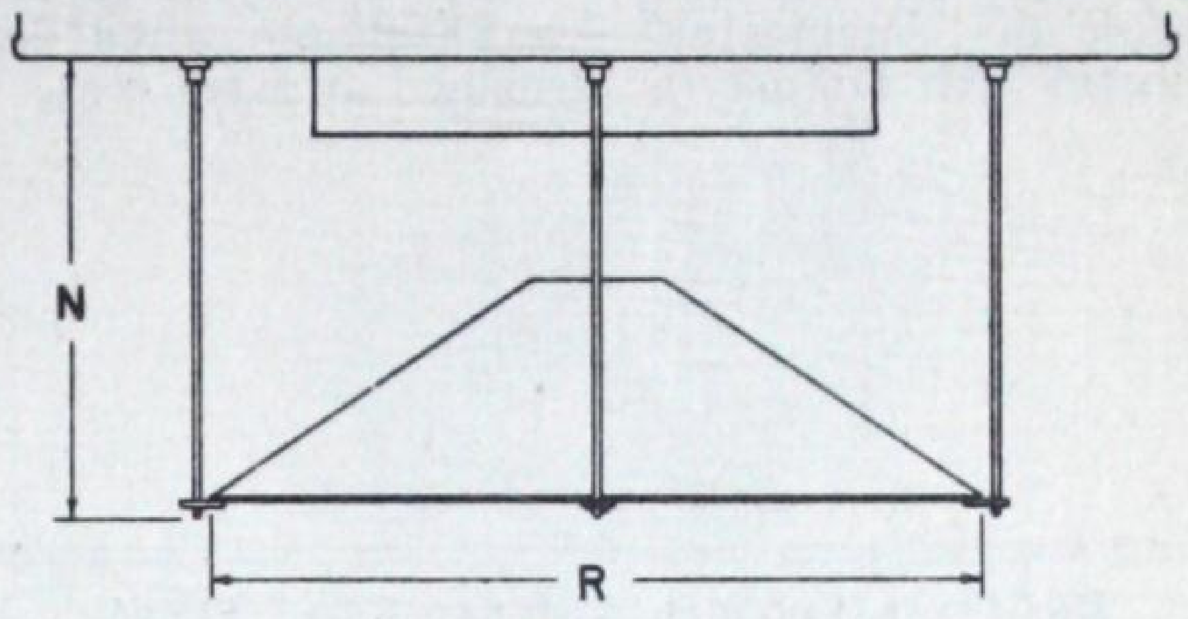


Fig. 3071A—Cone Discharge

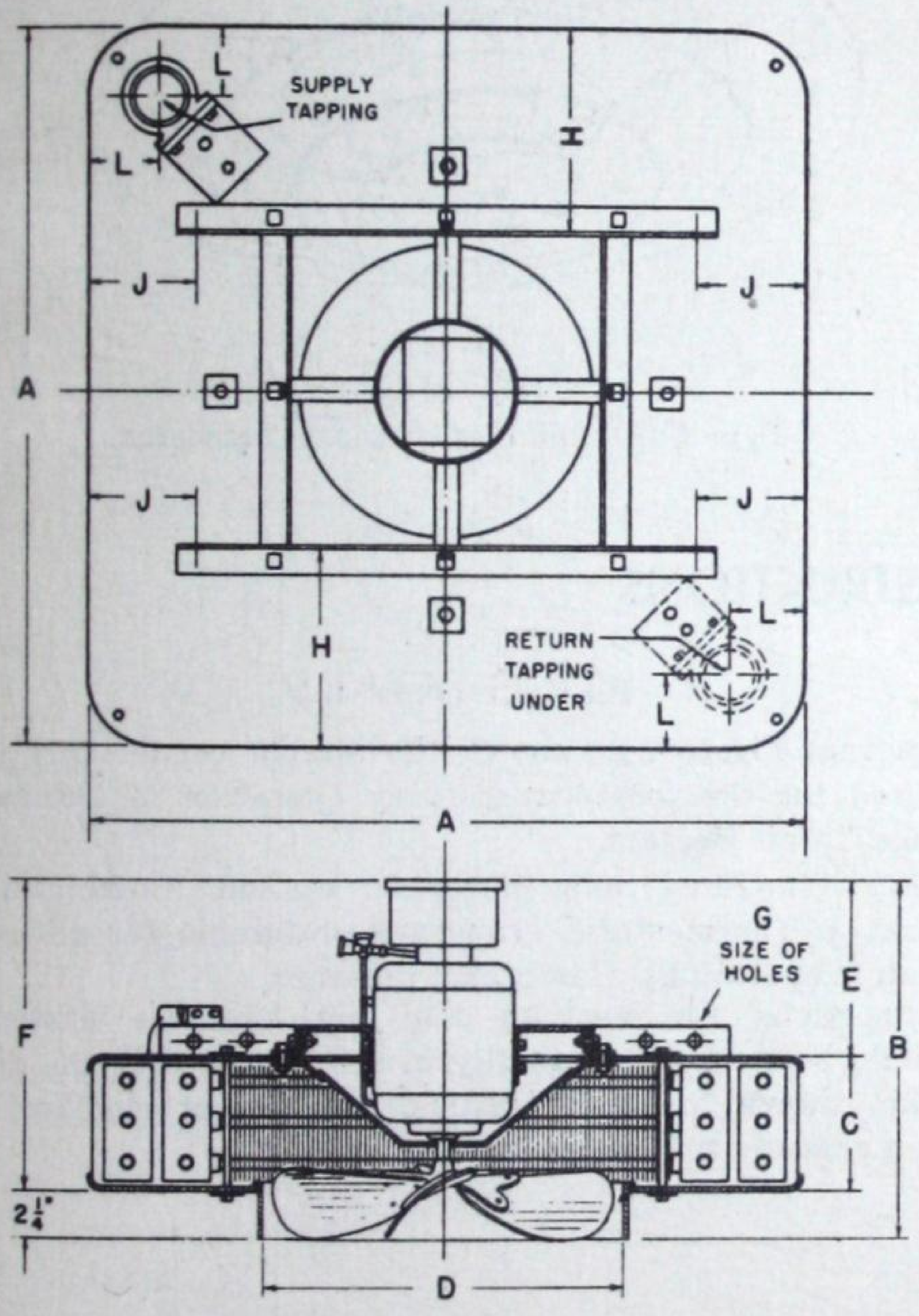


Fig. 2076D

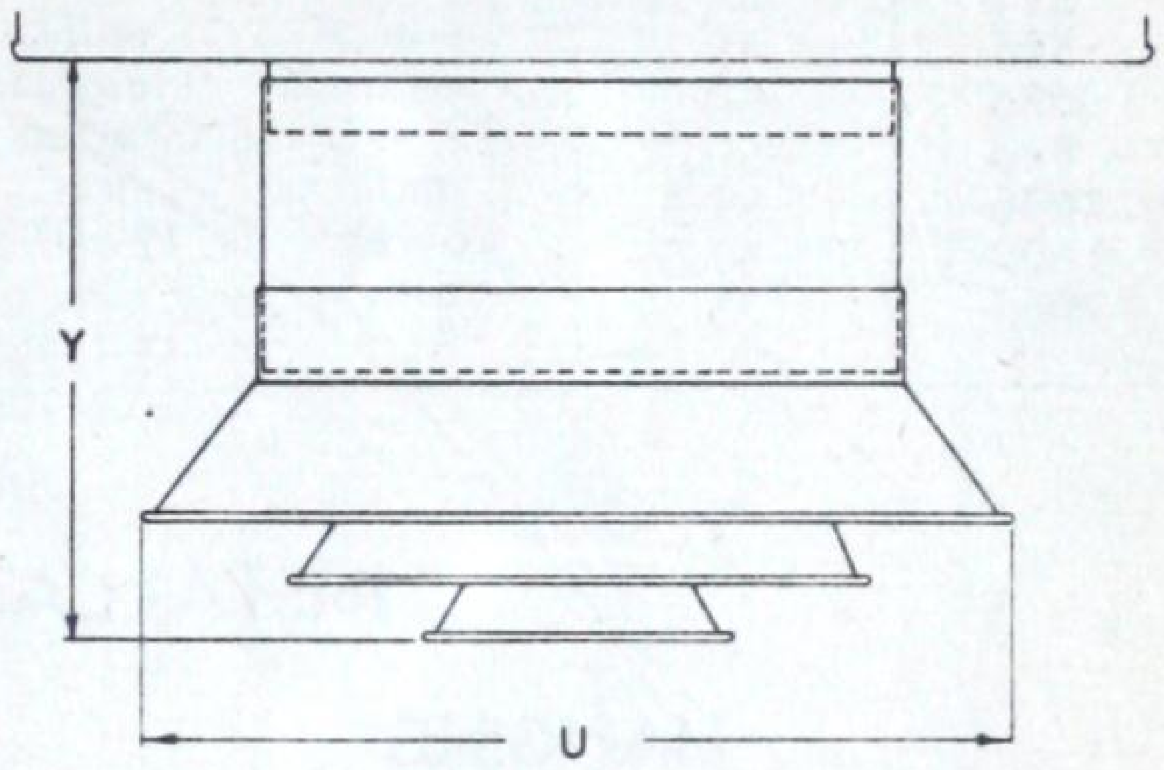


Fig. 3150—Anemostat Discharge

DIMENSIONS OF DISCHARGE ASSEMBLIES

Unit No.	M	N		R	U	Y
		Max.	Min.			
317	9½	16½	11⅜	22	27	18
525	9½	18½	12⅜	22	27	18
686	9½	18½	12⅜	24	30½	19
846	9½	18½	10⅛	24	30½	19
1036	9½	23½	15⅛	27	34½	20⅜
1600	9½	23½	12	27	34½	20⅜
2062	9½	23½	12	34	45½	23½

TAPPINGS AND DIMENSIONS OF UNIT HEATERS

Unit No.	TAPPINGS		DIMENSIONS									
	Supply	Return	A	B	C	D	E	F	G	H	J	L
317	**1¼**	**1¼**	30⅛	14⅞	5⅛	17⅞	7½	12⅝	⅜	8⅛	2¾	3½
525	**2**	**2**	30⅛	15¾	6⅛	17⅞	7⅜	13½	⅜	8⅛	2¾	3
686	**2**	**2**	35⅛	17¼	6⅛	19⅞	8⅞	15½	⅜	10 9/16	2¾	3
846	**2**	**2**	35⅛	19½	8⅜	19⅞	8⅞	17¼	½	10 9/16	2¾	3
1036	**2**	**2**	38⅛	19½	8⅜	22⅞	8⅞	17¼	½	10 1/16	3 1/16	3
1600	**2½**	**2½**	41⅛	23¼	11½	22⅞	9½	21	½	7 9/16	3 1/16	3
2062	**2½**	**2½**	50½	24¼	11½	30⅛	10½	22	½	12¼	5¾	3

ANEMOSTAT APPLICATION

The standard Air Discharge Assembly provides for the application of "Anemostat" Air Discharge when desired. "Anemostat" Air Diffuser is furnished at extra cost.

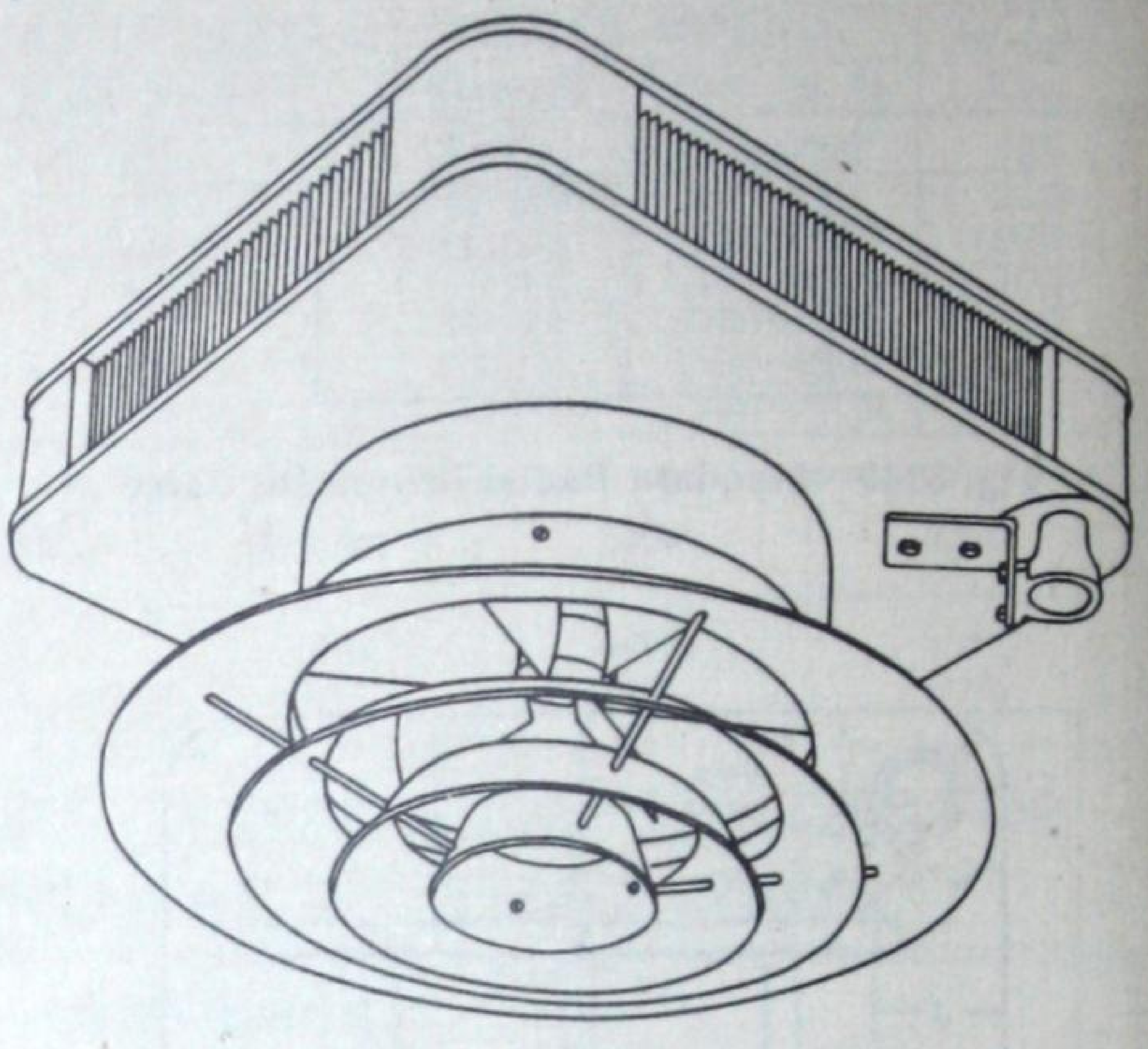


Fig. 3148
Type C-A Unit Heater with Anemostat

RECOMMENDED ANEMOSTAT SIZES

Unit No. and E.D.R.	Anemostat Size	Anemostat Type	
		Outlet	Outlet
317	45	For Ceiling Heights 12′-0″ and Lower use HU-4	For Ceiling Heights Greater than 12′-0″ use HU-3
525	45		
686	50		
846	50		
1036	57.5		
1600	57.5		
2062	75		

INSTALLATION INSTRUCTIONS

HANGING

Suspension should be made to the four hanger holes provided in angle iron frame on top of units. Units should be set level. Where conditions permit, a distance of 18″ from ceiling to top of heater casing is recommended to ensure air circulation over the motor.

Suspension rods, pipe, fittings, valves or traps are NOT furnished with the heaters.

Use 4 inside holes indicated for raising the heater into position. While heater is in suspension, insert hanging bars to place heater in permanent position by using the 4 outside holes.

PIPING DETAILS

Diagram, Fig. 2075 B, shows the simple connections required for the most satisfactory operation of Dunham Type C Unit Heaters.

Return tappings must never be bushed. Combination Float & Thermostatic Traps are preferable for all unit heaters operating on low steam pressure.

Connections for medium and high-pressure systems should be made substantially in accordance with the diagram shown for low pressure, except that medium or high pressure traps must be used.

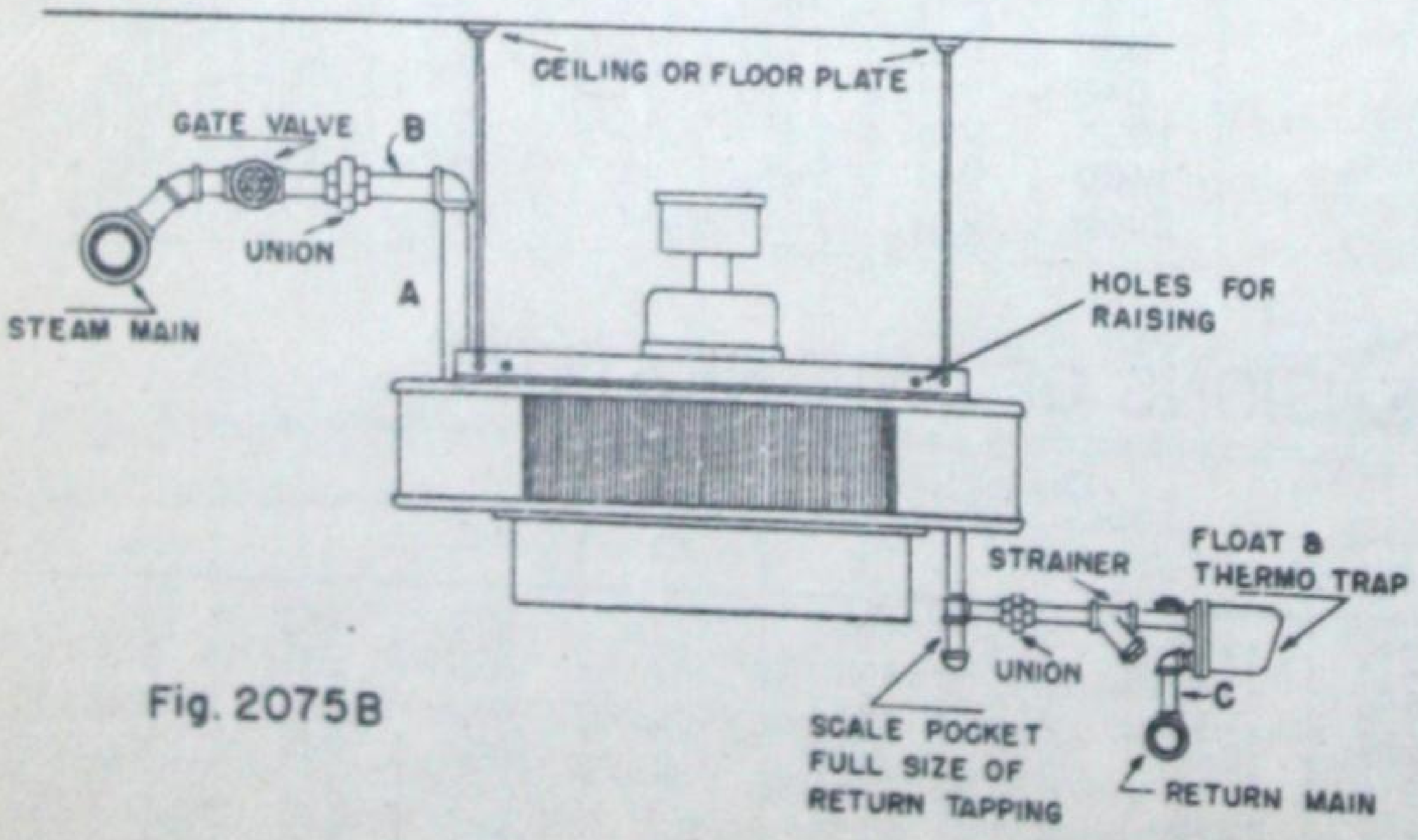


Fig. 2075B

PIPE SIZES

Unit No.	Steam Connection to Unit "A"	Runout to Steam Main "B"	Return "C"
317	1¼″	1½″	1″
525	2″	2″	1″
686	2″	2½″	1″
846	2″	2½″	1″
1036	2″	2½″	1″
1600	2½″	3″	1¼″
2062	2½″	3″	1¼″

DUNHAM AIR ELIMINATOR

TYPE 220B

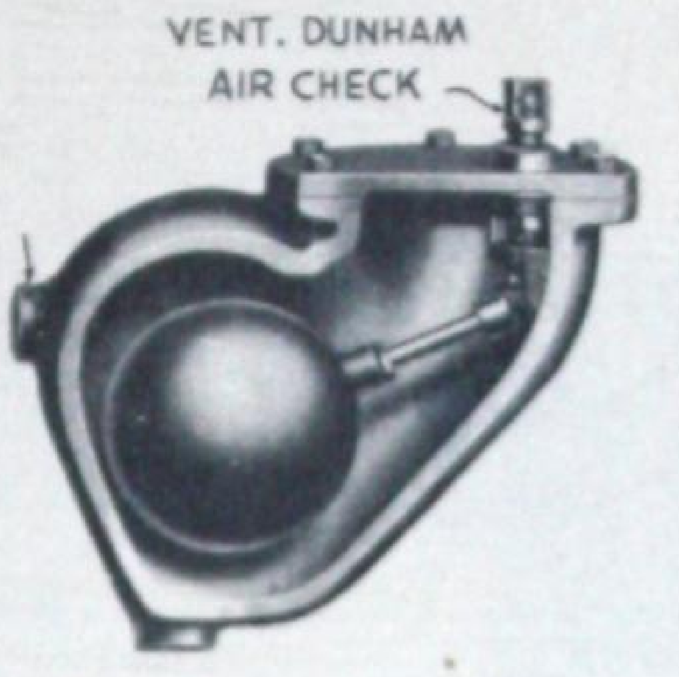


Fig. 1788 A—Sectional View
Type 220B Air Eliminator

The Dunham Air Eliminator is used to vent air from the return piping of gravity steam heating systems. It prevents water from escaping. It is always open to atmosphere except when pressure on the boiler causes water to close mechanism.

TYPICAL INSTALLATION

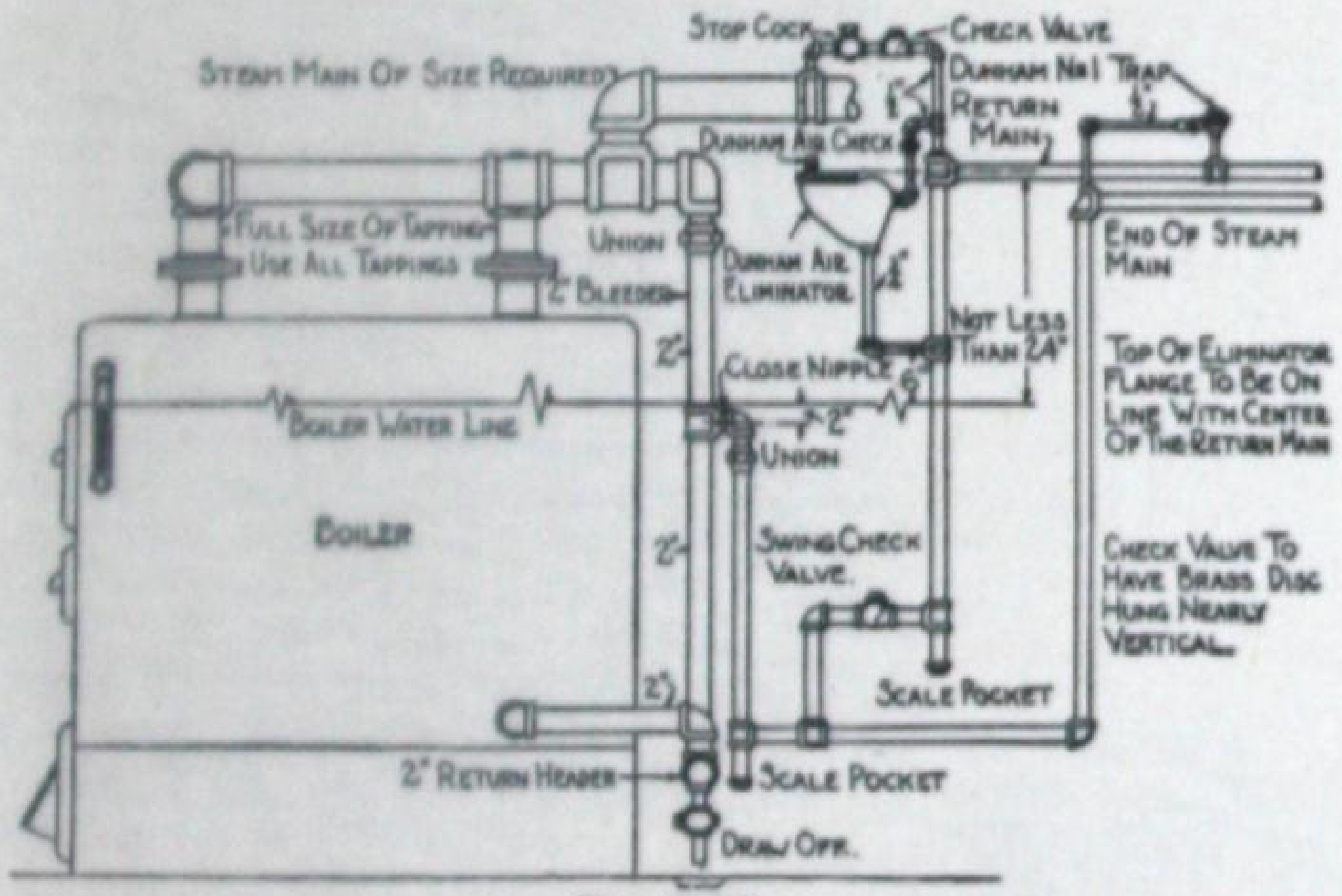


Fig. 937C
Method of installing Eliminator Type 220B on installations using boiler with two or more supply tappings

DIMENSIONS

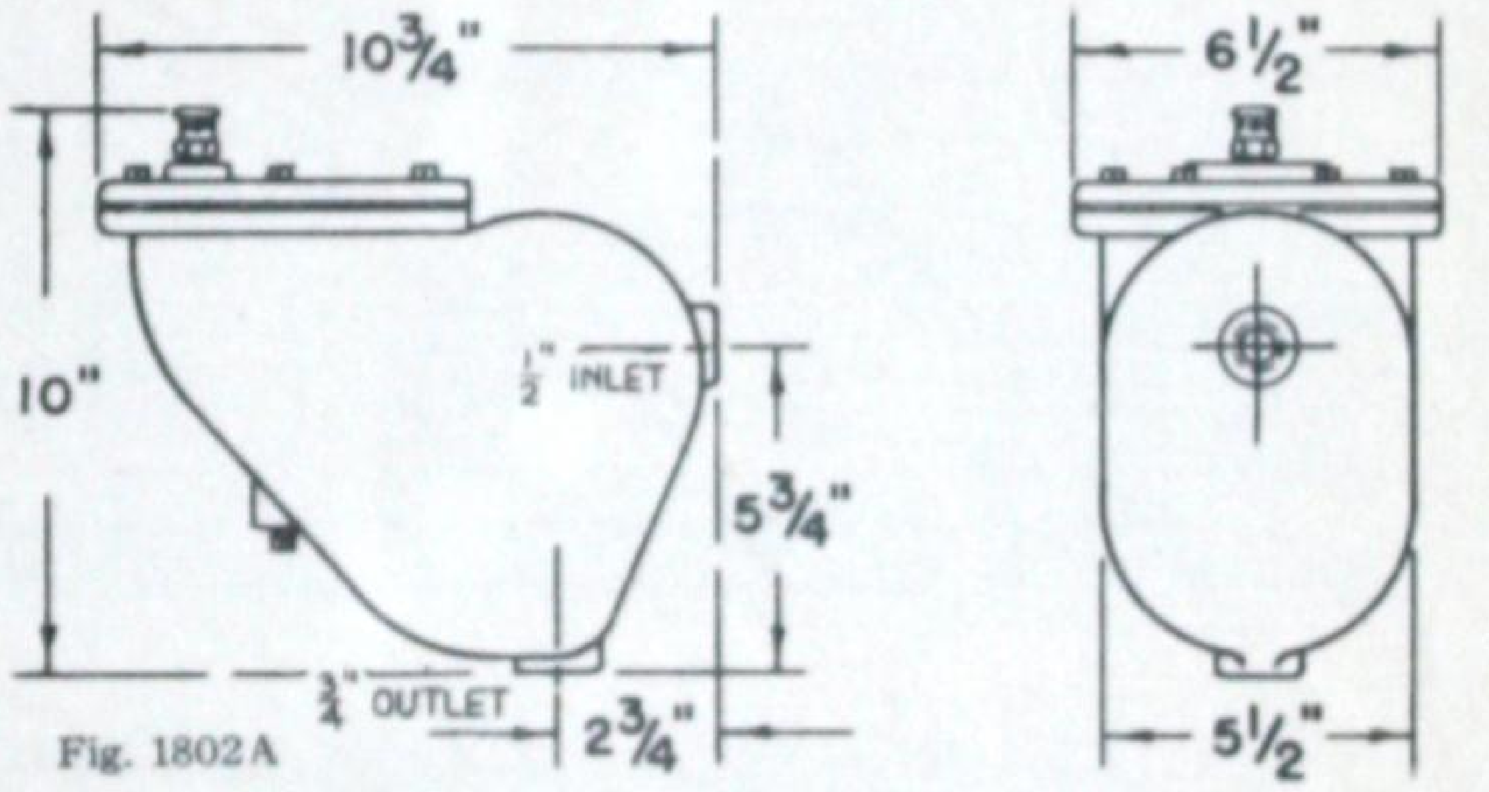


Fig. 1802 A

The Type 220B Air Eliminator includes the Dunham Air Check Type 222 to be placed in the ⅜" vent tapping.
Specify Catalog number or Type number on order.

PARTS

When parts are required for Air Eliminators, we recommend that mechanism complete be furnished. These are assembled and tested as a unit at the factory before shipment. This method will assure proper functioning of the eliminator after repairs are completed. When ordering mechanism, please give complete type number cast on the Eliminator.

1. Body
2. Cover
3. Seat
4. Valve
5. Float Arm Head
6. Float Arm
7. Valve Link
8. Float
9. Fulcrum Pin
10. Float Arm Head Pin
11. Valve Pin
12. Seat Gasket
13. Cover Gasket

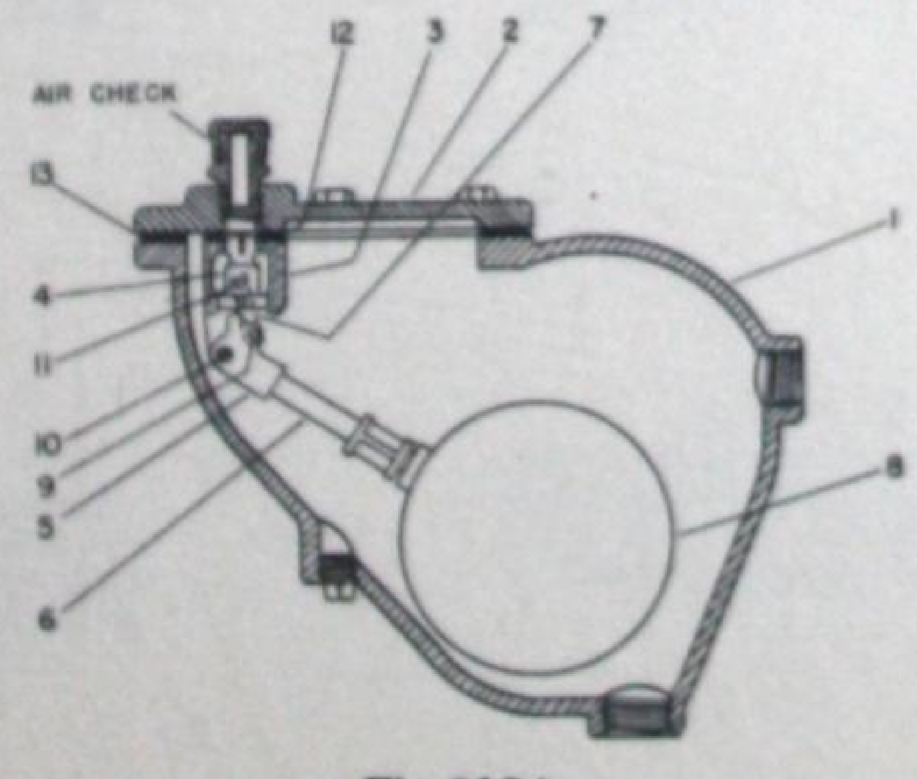


Fig. 3134

DUNHAM AIR CHECK TYPE 222

The Dunham Air Check is applied to the Type 220B Dunham Air Eliminator. It releases air at the slightest pressure but prevents re-entrance into the system. It is also used to vent the Accumulator Tank on Differential and Vacuum Return Line Heating systems.

Pipe Thread..............⅜"
Cat. No...............AC⅜
Code..................Vascheck

PARTS

14. Body
15. Cap
16. Disc

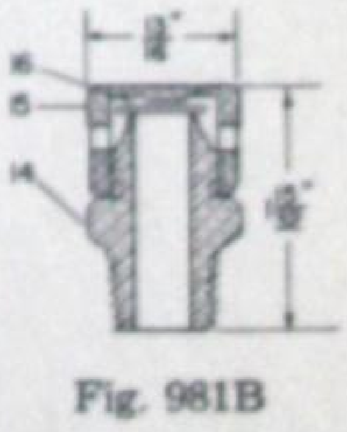


Fig. 981B
Section and Dimensions
Dunham Air Check

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THE DUNHAM LIFT FITTING

TYPE 780

It is of course best practice to design a vacuum return line heating system without lifts or pick-ups, but sometimes the fitter is confronted with a job where the returns cannot be brought to the vacuum pump in any other way. This scientifically designed Dunham fitting will, in such cases, eliminate guess work as to design and operation.

These fittings however must never be used on a Differential Vacuum Heating System. They must not be used on a vacuum return line system where steam pressure will not be maintained continuously on the heating mains throughout the entire heating season. They therefore must not be used on the end of steam mains, or where the main rises and drips on the ordinary low pressure vacuum return line system because on these installations the system is allowed to cool down completely during mild days and water hammer might develop, when the system is fired up, before sufficient differential in pressure has been created to lift the water out of the steam main.

In most cases by giving careful study to piping, the system can be designed to eliminate lift fittings.

Avoid lift connections in return main, except right at the vacuum pump. If needed at this point, arrange so that all returns pass through the lift connection.

If it becomes necessary to use lift connections in overcoming obstacles the Dunham Lift Fitting will simplify the connection and eliminate errors often made in assembling such connections from standard pipe and fittings.

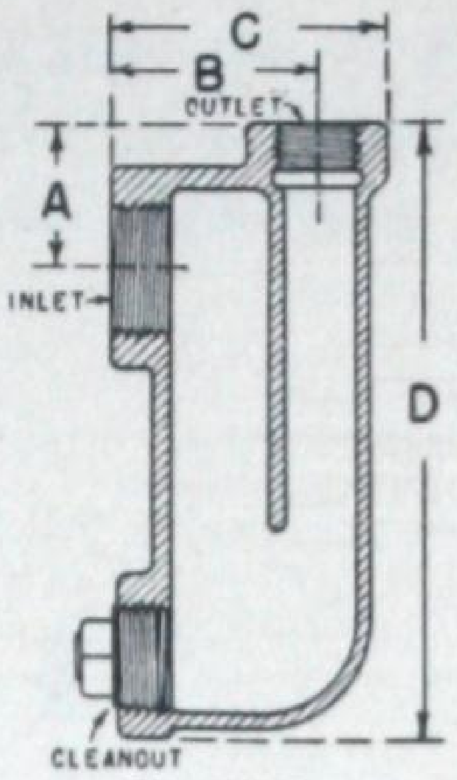
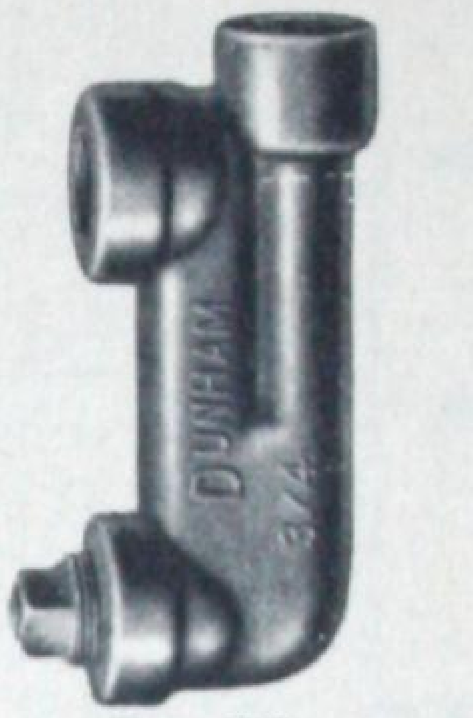


Fig. 954A

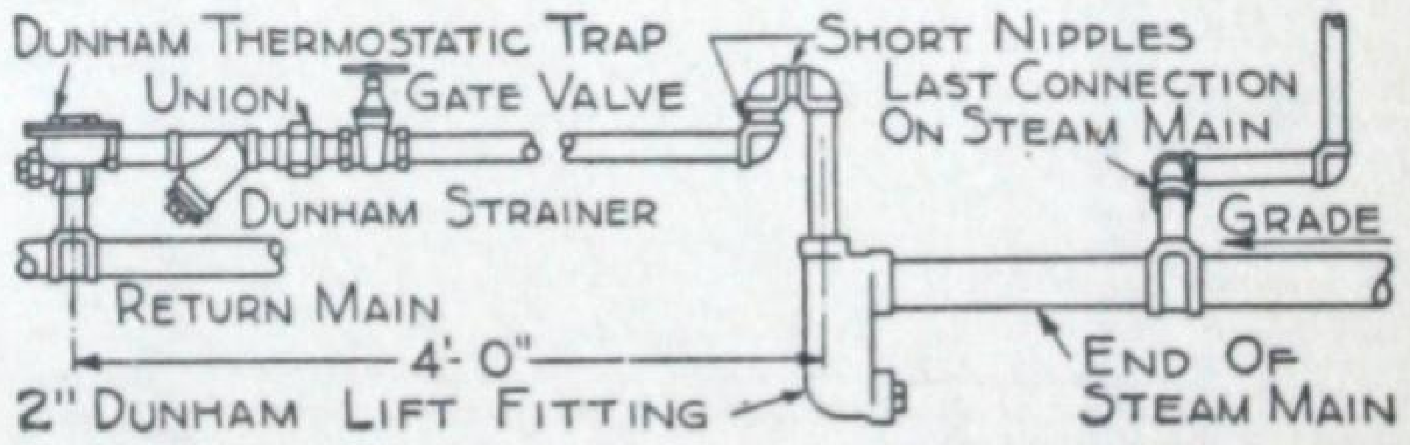


Type 780

Size Inches	Cat. No.	Net Weight Lbs.	Code	Tappings			Dimensions in Inches			
				In-let	Out-let	Clean out	A	B	C	D
¾	LF¾	2½	Litang	¾	½	¾	1⅜	1¾	2 9/16	6⅛
1	LF1	3	Literal	1	½	1	1½	2⅛	2⅞	6¾
1¼	LF1¼	4	Lithium	1¼	¾	1	1¾	2½	3⅜	7¾
1½	LF1½	5½	Litigant	1½	¾	1	2	2⅞	3 13/16	8⅝
2	LF2	8	Litmus	2	1	1	2¼	3⅝	4⅝	9¾

All connections are right hand female pipe tappings.
Specify Catalog number or Type number and size on order.

Fig. 955A
Drip connection using Thermostatic Trap to drain small steam main with drip point below return. Vacuum return line systems only.



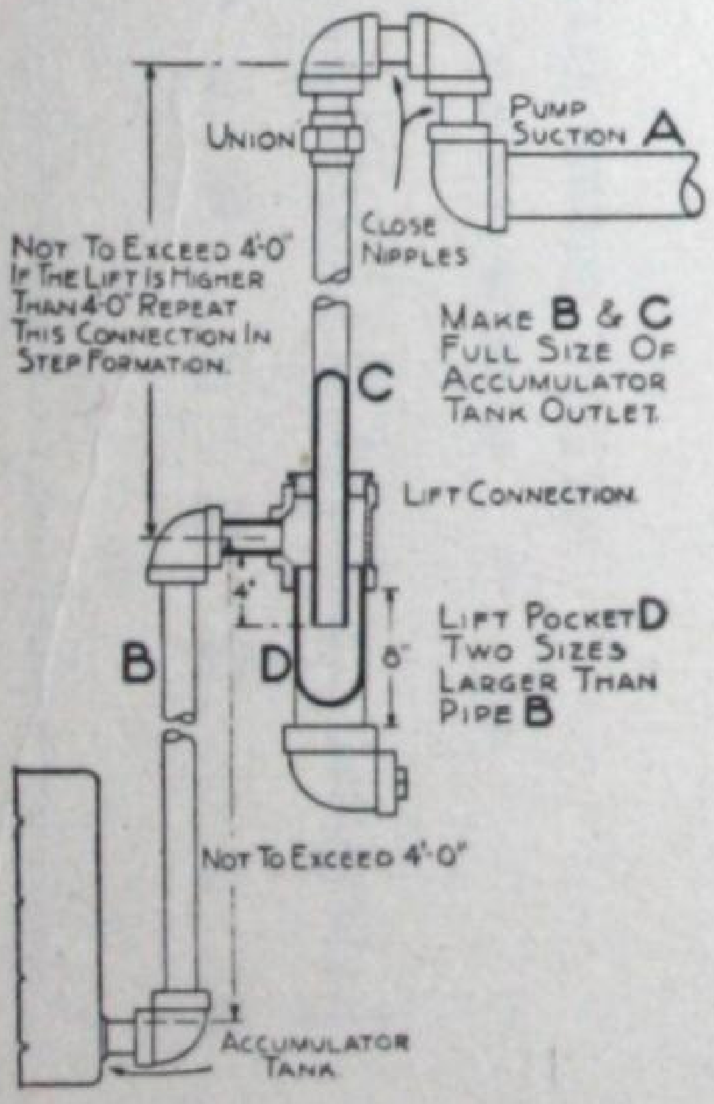

Union
Pump Suction A
Close Nipples
Not To Exceed 4'-0" If The Lift Is Higher Than 4'-0" Repeat This Connection In Step Formation.
Make B & C Full Size Of Accumulator Tank Outlet.
C
Lift Connection
4"
B
D
8"
Lift Pocket D Two Sizes Larger Than Pipe B
Not To Exceed 4'-0"
Accumulator Tank

Fig. 1181
Showing how lift connection in vacuum return main larger than 2-inch may be built of pipe and fittings.

Fig. 956A
Drip connection using Float and Thermostatic Trap for draining steam main with drip point below return. Applies to vacuum return line systems only.

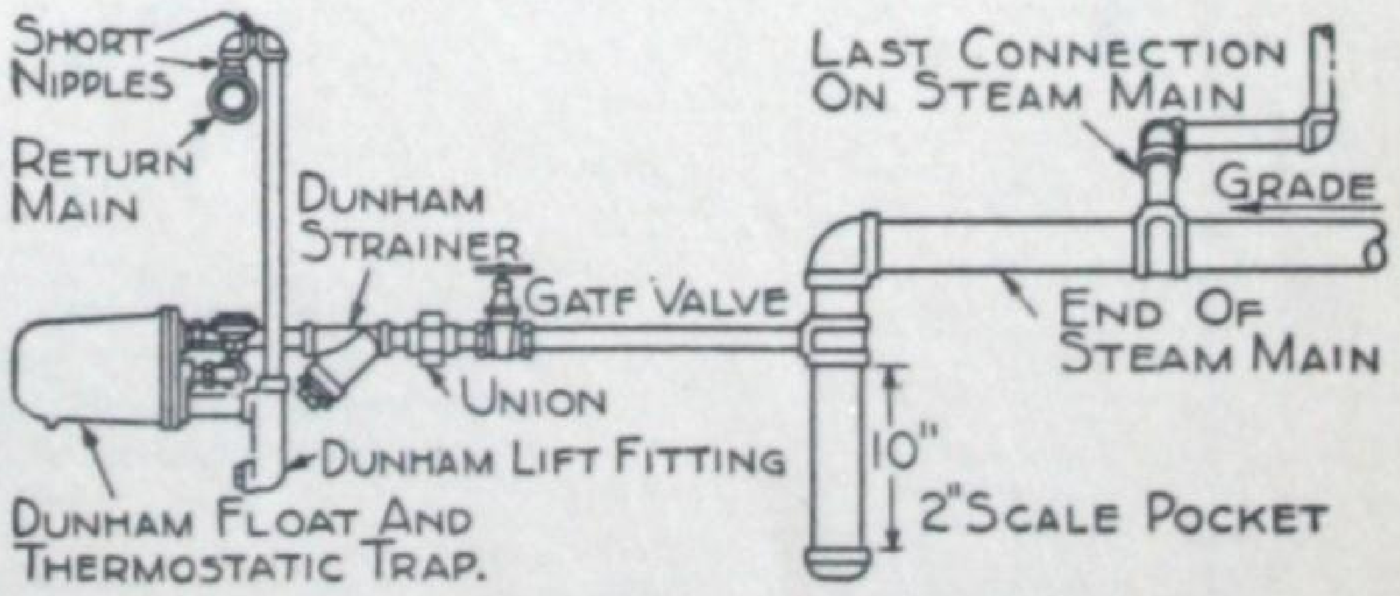
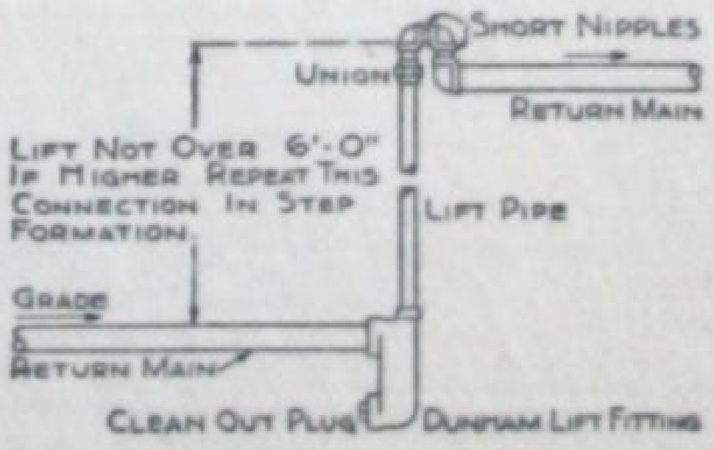


Fig. 957A
Lift Connection for the return main of vacuum return line system located lower than pump inlet.



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API INTERNATIONAL

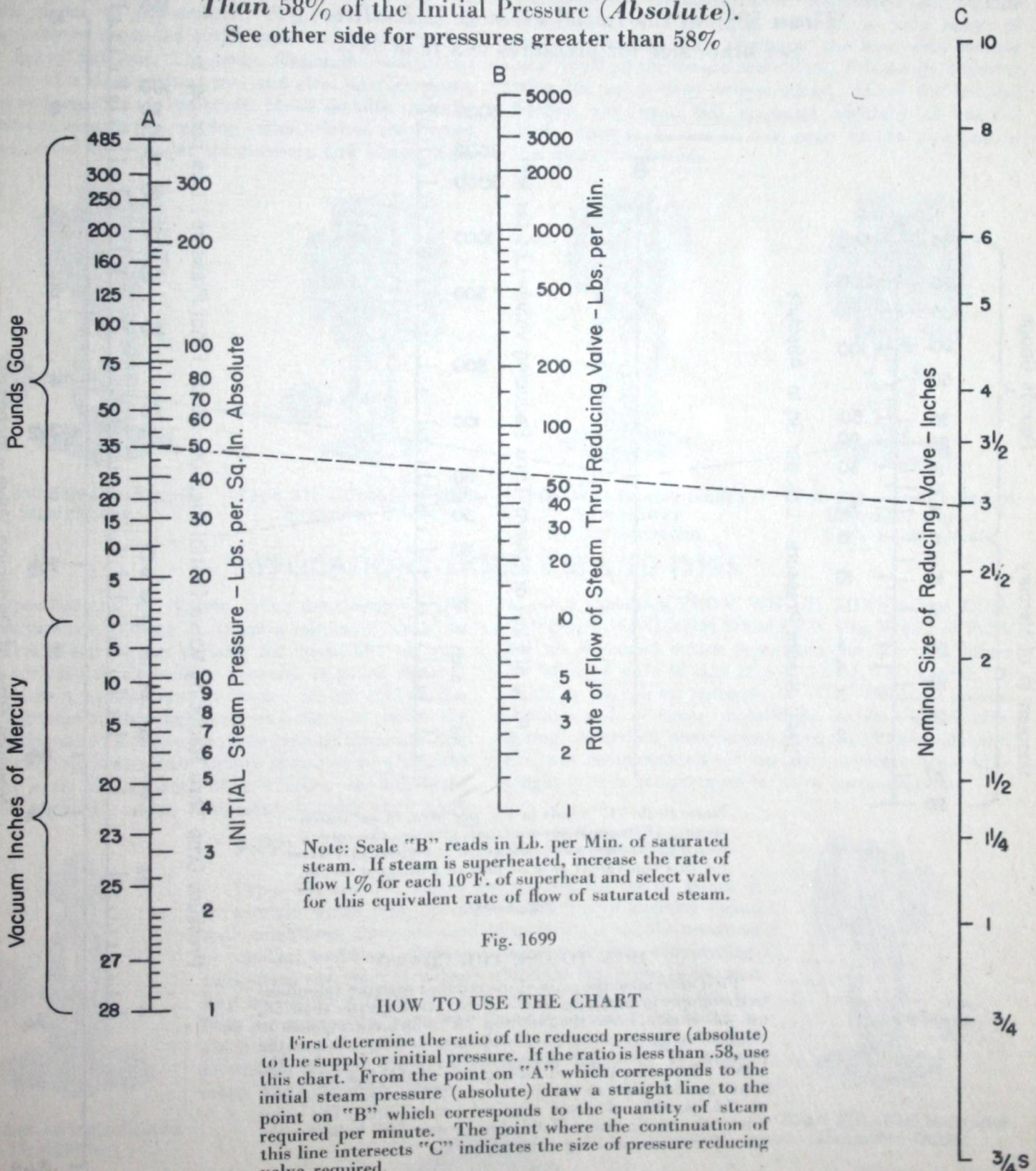
CCA

SIZING PRESSURE REDUCING VALVES

TYPES 340, 370, 300, 310, 301 and 311

The proper size of pressure reducing valve must be selected to insure proper service. If a valve is too large, it may not be able to hold the reduced pressure on the controlled main or fixture down to the desired level. Under some conditions the pressures will tend to build up on the reduced side. Or in holding the desired reduced pressure, the inner valve may have to work so close to its seat that operation may be noisy and wear excessive.

Sizing Chart for use where the Final Pressure is ***Less Than*** 58% of the Initial Pressure (***Absolute***).
See other side for pressures greater than 58%



Note: Scale "B" reads in Lb. per Min. of saturated steam. If steam is superheated, increase the rate of flow 1% for each 10°F. of superheat and select valve for this equivalent rate of flow of saturated steam.

Fig. 1699

HOW TO USE THE CHART

First determine the ratio of the reduced pressure (absolute) to the supply or initial pressure. If the ratio is less than .58, use this chart. From the point on "A" which corresponds to the initial steam pressure (absolute) draw a straight line to the point on "B" which corresponds to the quantity of steam required per minute. The point where the continuation of this line intersects "C" indicates the size of pressure reducing valve required.

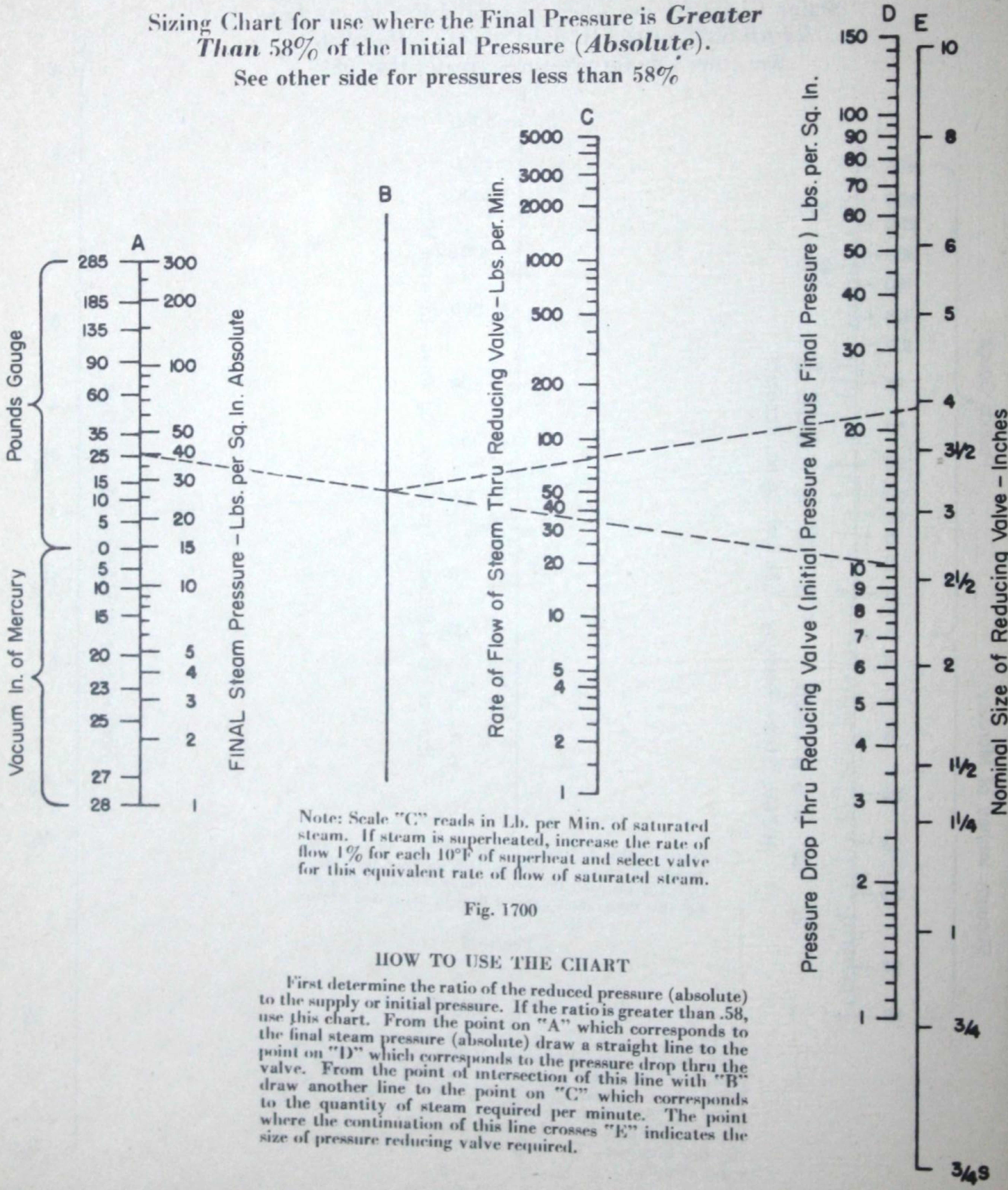
SIZING PRESSURE REDUCING VALVES

TYPES 340, 370, 300, 310, 301 and 311

If a pressure reducing valve which is too small for the service is selected, the steam flow through it will be insufficient to enable the reduced pressure to be as high as desired. The accompanying charts are provided to aid in selecting the proper size of valve. At times the supply pipe may necessarily be larger than the valve. The supply pipe to the valve should be one which will carry the proper weight of steam with velocities in it from 6000 to 8000 ft. per minute.

Sizing Chart for use where the Final Pressure is ***Greater Than*** 58% of the Initial Pressure (***Absolute***).

See other side for pressures less than 58%



Note: Scale "C" reads in Lb. per Min. of saturated steam. If steam is superheated, increase the rate of flow 1% for each 10°F of superheat and select valve for this equivalent rate of flow of saturated steam.

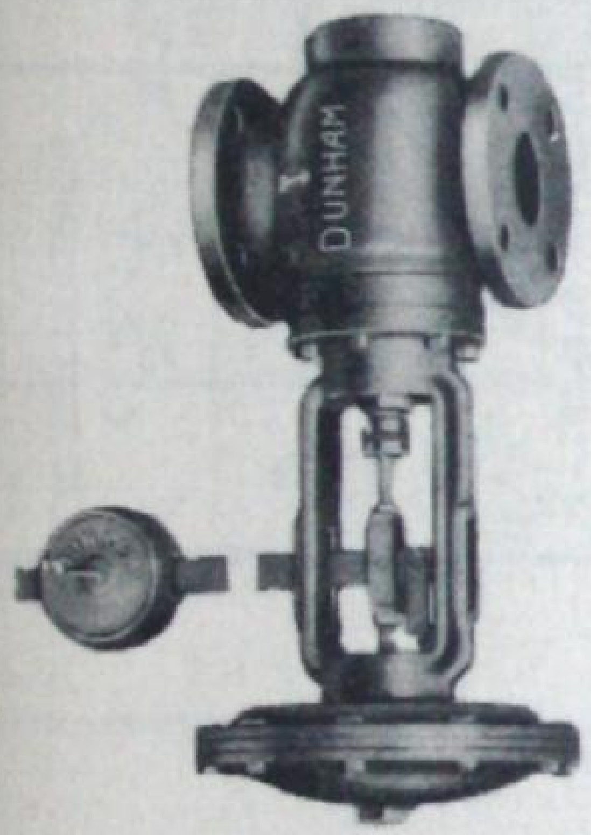
Fig. 1700

HOW TO USE THE CHART

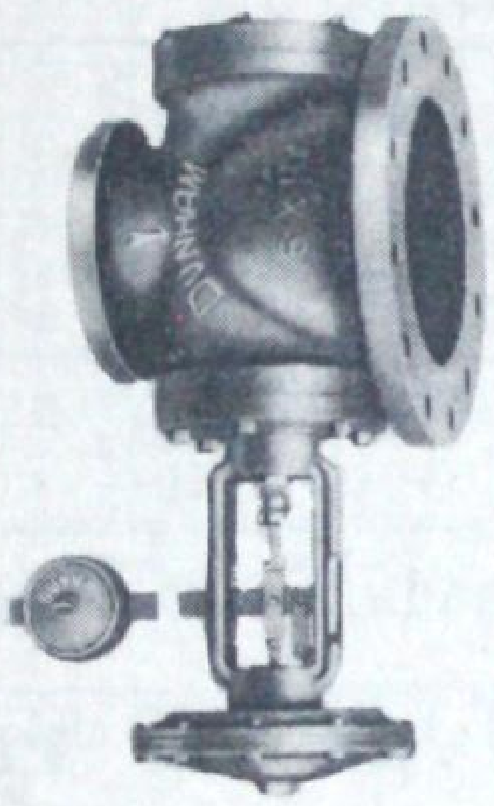
First determine the ratio of the reduced pressure (absolute) to the supply or initial pressure. If the ratio is greater than .58, use this chart. From the point on "A" which corresponds to the final steam pressure (absolute) draw a straight line to the point on "D" which corresponds to the pressure drop thru the valve. From the point of intersection of this line with "B" draw another line to the point on "C" which corresponds to the quantity of steam required per minute. The point where the continuation of this line crosses "E" indicates the size of pressure reducing valve required.

DUNHAM
PRESSURE REDUCING VALVES

These valves are made in double-seated and single-seated designs for initial steam or air pressures up to a maximum of 250 pounds and delivery pressures from 125 pounds down to atmosphere. They are available in straightway or expanded outlet types and in standard or extra heavy patterns. The body, diaphragm casing and yoke are of a close-grained iron and steel mixture. Inner valves and seats are of Dunhamite Metal, an alloy specially resistant to erosive and cutting action. Valves are ground in and tested tight under the pressure and temperature conditions for which they are individually ordered. The diaphragm is of para rubber reinforced by laminated woven fabric. Standardization of construction permits interchange of diaphragms to meet a wide range of reduced pressure. The hinging of the lever arm reduces side thrust on the bronze valve stem. This design, together with the extra deep bronze gland, makes for reduced friction and wear and increased accuracy of control. Yokes may be turned at any angle to the pipe line to suit space limitations.

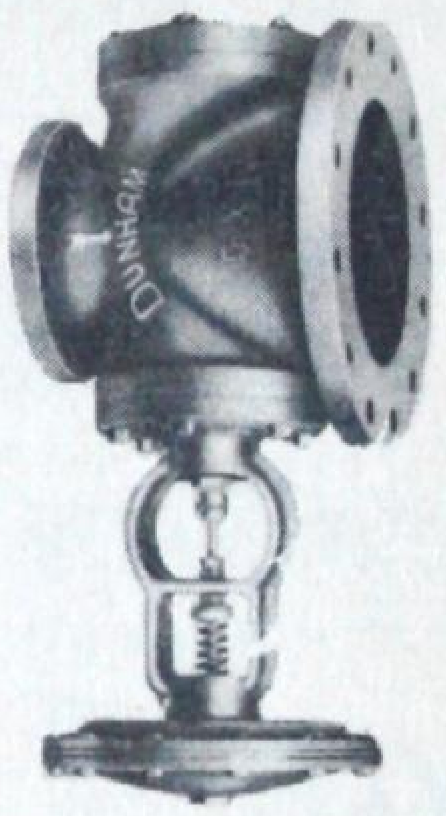


Type 300—Double-Seated Straightway



Type 310—Double-Seated Expanded Outlet

Type 301—Double-Seated Straightway Spring-controlled

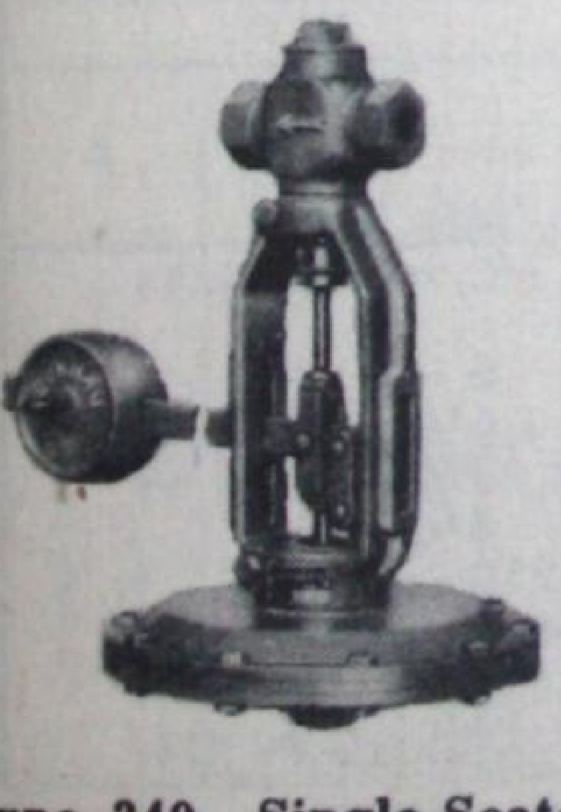


Type 311—Double-Seated Expanded Outlet Spring-controlled

APPLICATIONS - DOUBLE SEATED TYPES

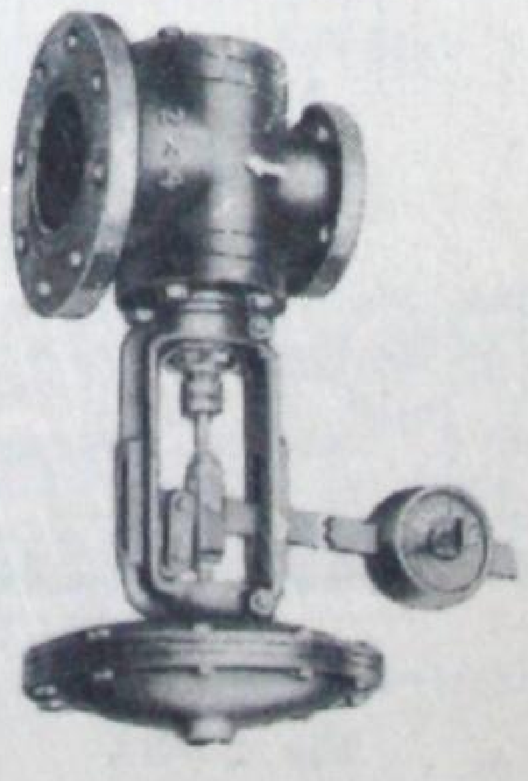
Types 300 and 310 Valves, being double-seated, give best service where there is always a minimum 'draw' on the valve. They are not suitable for "dead end" service. They are used to control the pressure at which steam is supplied to a heating system from a central station distributing main or from high-pressure boilers; to control the automatic make-up of live steam to exhaust steam heating systems; to regulate steam supply pressures to groups of fixtures such as batteries of sterilizers, or individual fixtures, such as cooking equipment, laundry equipment or other apparatus FROM WHICH THERE IS A CONTINUOUS MINIMUM DEMAND. The Type 310 Valve has an expanded outlet permitting the use of a larger low-pressure main to take care of the large increase in the steam or air volume through the valve without a corresponding and, at times, undesirable increase in velocity. Spring-controlled, double-seated valves, Types 301 and 311, are recommended for use only where a lever-and-weight type is not permissible, as in marine service.

APPLICATIONS - SINGLE SEATED TYPES



Type 340—Single-Seated Straightway

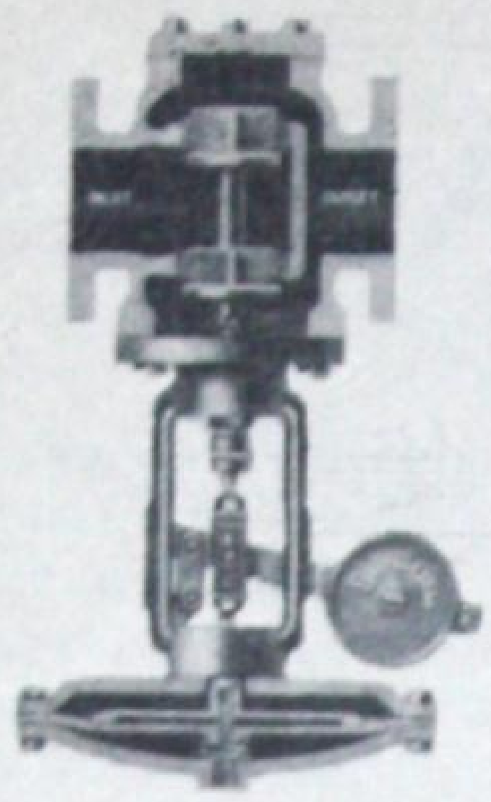
Types 340 and 370 Valves are adapted for use on steam or air services which may operate intermittently creating "dead end" conditions. They are used to govern the supply pressures to cooking, warming, sterilizing, ironing, drying, evaporating, vulcanizing and other services in which the low-pressure demand may be cut off without shutting off the high-pressure supply. They are suitable for hot water tanks and other applications in which the steam-using equipment is under cyclical or other automatic control. They serve fixtures singly or in groups within their capacity limits.



Type 370—Single-Seated Expanded Outlet

ENGINEERING DATA

Type 300 Valves



Double-Seated Valve Section

Size Inches	Screwed Connections 250 Lb. Initial Press.		Flanged Connections Standard 125 Lb. Initial Press.		Flanged Connections Extra Heavy 250 Lb. Initial Press.	
	Cat. No.	Ship. Wt. Lb.	Cat. No.	Ship. Wt. Lb.	Cat. No.	Ship. Wt. Lb.
1½	RDS1½	110	RDF1½	115	RDXF1½	125
2	RDS2	120	RDF2	130	RDXF2	140
2½	RDS2½	130	RDF2½	140	RDXF2½	150
3	....	...	RDF3	150	RDXF3	160
3½	....	...	RDF3½	160	RDXF3½	170
4	....	...	RDF4	200	RDXF4	210
5	....	...	RDF5	250	RDXF5	260
6	....	...	RDF6	310	RDXF6	320
8	....	...	RDF8	420	....	...

Principal Dimensions (Fig. 2005A)

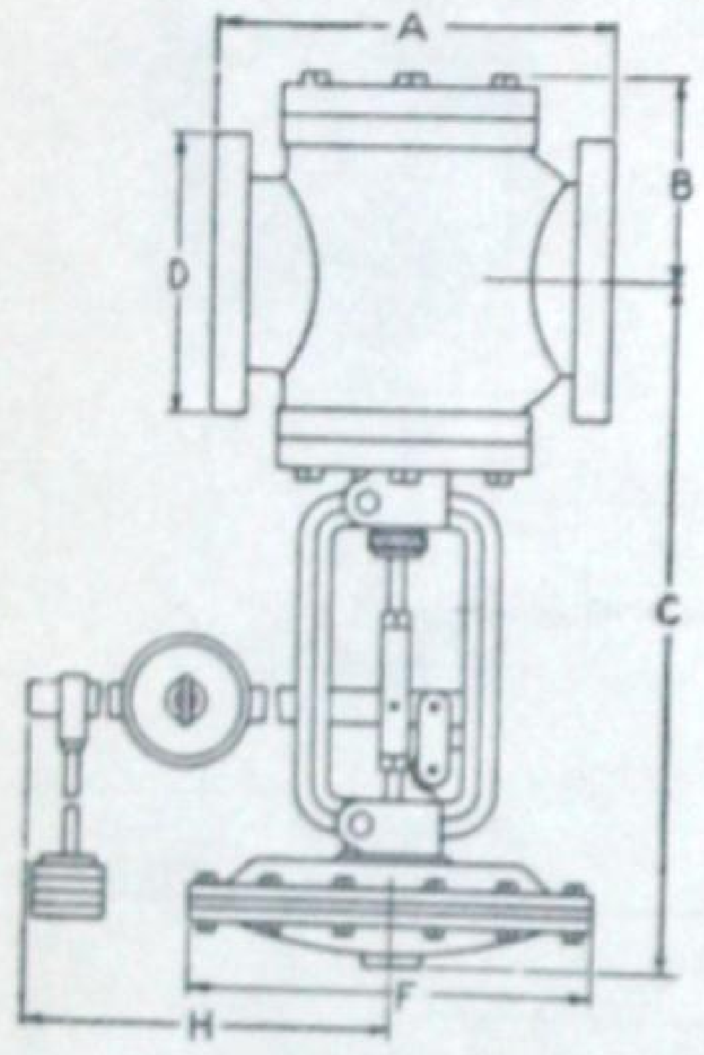


Fig. 2005A

Size Inches	Dimensions in Inches							
	A			B	C Max.	D		F
	Scrd.	Std. Flgd.	Hvy. Flgd.			Std. Flgd.	Hvy. Flgd.	
1½	7	7¾	8¼	4¼	17¼	5	6	6" to 13" to suit pressures
2	8$^{3}/_{16}$	8⅜	8⅞	4¼	17¾	6	6½	
2½	9	9	9⅝	5½	18¼	7	7½	
3	....	10¼	11	5½	19	7½	8¼	
3½	....	10⅜	11⅛	5½	19	8½	9	
4	....	12	12⅝	6½	20	9	10	
5	....	13	13⅞	7½	21	10	11	
6	....	14¾	15⅝	8½	21¾	11	12½	
8	....	19	19¼	10½	25	13½	15	

Dimension "H" is 25½" for all sizes.

Type 310 Valves

Size Inches	Screwed Connections 250 Lb. Initial Press.		Flanged Connections Standard 125 Lb. Initial Press.		Flanged Connections Extra Heavy Inlet 250 Lb. Initial Press.	
	Cat. No.	Ship. Wt. Lb.	Cat. No.	Ship. Wt. Lb.	Cat. No.	Ship. Wt. Lb.
1 x 2	RDS1x2	105	....	...	....	...
1¼x 2½	RDS1¼x2½	115	....	...	....	...
1½x 3	....	...	RDF1½x 3	130	RDXF1½x 3	140
2 x 4	....	...	RDF2 x 4	145	RDXF2 x 4	155
2½x 5	....	...	RDF2½x 5	155	RDXF2½x 5	165
3 x 6	....	...	RDF3 x 6	165	RDXF3 x 6	175
4 x 8	....	...	RDF4 x 8	215	RDXF4 x 8	225
5 x10	....	...	RDF5 x10	265	RDXF5 x10	275
6 x 8	....	...	RDF6 x 8	340	RDXF6 x 8	350
6 x12	....	...	RDF6 x12	450	RDXF6 x12	460

Principal Dimensions (Fig. 2006A)

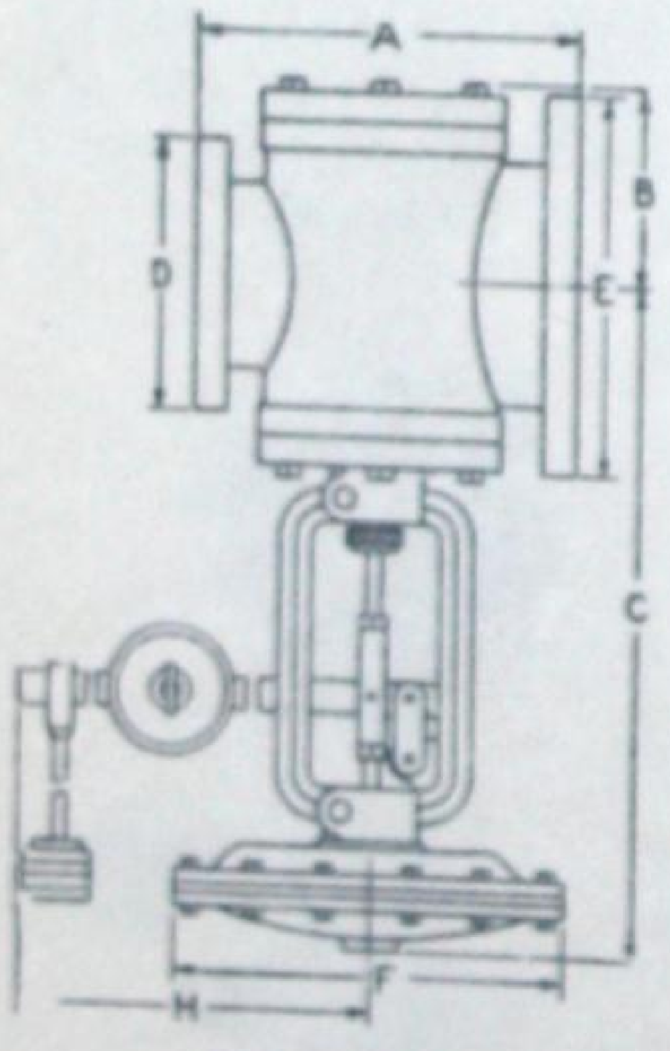


Fig. 2006A

Size Inches	Dimensions in Inches								
	A			B	C Max.	D		E	F
	Scrd.	Std. Flgd.	Hvy. Flgd.			Std. Flgd.	Hvy. Flgd.		
1 x 2*	6⅛	....	....	4	15¾	...	..	..	6" to 13" to suit pressures
1¼x 2½*	6¾	....	....	4	15¾	...	..	..	
1½x 3	...	8$^{1}/_{16}$	8$^{5}/_{16}$	4¼	17¼	5	6	7½	
2 x 4	...	8$^{11}/_{16}$	8$^{15}/_{16}$	4¼	17¾	6	6½	9	
2½x 5	...	9$^{3}/_{16}$	9½	5½	18¼	7	7½	10	
3 x 6	...	10¾	11⅛	5½	19	7½	8¼	11	
4 x 8	...	12½	12$^{13}/_{16}$	6½	20	9	10	13½	
5 x10	...	13⅛	13$^{9}/_{16}$	7½	21	10	11	16	
6 x 8	...	14$^{11}/_{16}$	15⅛	8½	21¾	11	12½	13½	
6 x12	...	14¾	15$^{3}/_{16}$	8½	21¾	11	12½	19	

*Screwed connections only.

Dimension "H" is 25½" for all sizes.

Type 340 Valves

Size Inches	Screwed Connections 250 Lb. Initial Press.		Flanged Connections Standard 125 Lb. Initial Press.		Flanged Connections Extra Heavy 250 Lb. Initial Press.	
	Cat. No.	Ship. Wt. Lb.	Cat. No.	Ship. Wt. Lb.	Cat. No.	Ship. Wt. Lb.
¾S	RSS¾S	53	...	...	...	...
¾	RSS¾	53	...	...	...	...
1	RSS1	80	...	...	...	...
1¼	RSS1¼	90	...	...	...	...
1½	RSS1½	110	RSF1½	115	RSXF1½	125
2	RSS2	120	RSF2	130	RSXF2	140
2½	RSS2½	130	RSF2½	140	RSXF2½	150

Principal Dimensions (Fig. 2007)

Size Inches	Dimensions in Inches							
	A			B	C Max.	D (See Fig. 2006)		F
	Scrd.	Std. Flgd.	Hvy. Flgd.			Std. Flgd.	Hvy. Flgd.	
¾S	5	....	....	2½	15¾	....	....	6" to 13" to suit pressures
¾	5	....	....	2½	15¾	....	....	
1	5	....	....	2½	15¾	....	....	
1¼	5	....	....	2½	15¾	....	....	
1½	7	7¾	8¼	4¼	17¼	5	6	
2	8 3/16	8⅜	8⅞	4¼	17¾	6	6½	
2½	9	9	9⅝	5½	18¼	7	7½	

Dimension "H" is 25½" for all sizes.

Type 370 Valves

Size Inches	Flanged Connections Standard 125 Lb. Initial Press.		Flanged Connections Extra Heavy Inlet 250 Lb. Initial Press.	
	Cat. No.	Ship. Wt. Lb.	Cat. No.	Ship. Wt. Lb.
1½ x 3	RSF1½x3	130	RSXF1½x3	140
2 x 4	RSF2x4	145	RSXF2x4	155
2½ x 5	RSF2½x5	155	RSXF2½x5	165

Principal Dimensions (Fig. 2006A)

Size Inches	Dimensions in Inches							
	A		B	C Max.	D		E	F
	Std. Flgd.	Hvy. Flgd.			Std. Flgd.	Hvy. Flgd.		
1½ x 3	8 1/16	8 5/16	4¼	17¼	5	6	7½	6" to 13" to suit pressures
2 x 4	8 11/16	8 15/16	4¼	17¾	6	6½	9	
2½ x 5	9 3/16	9½	5½	18¼	7	7½	10	

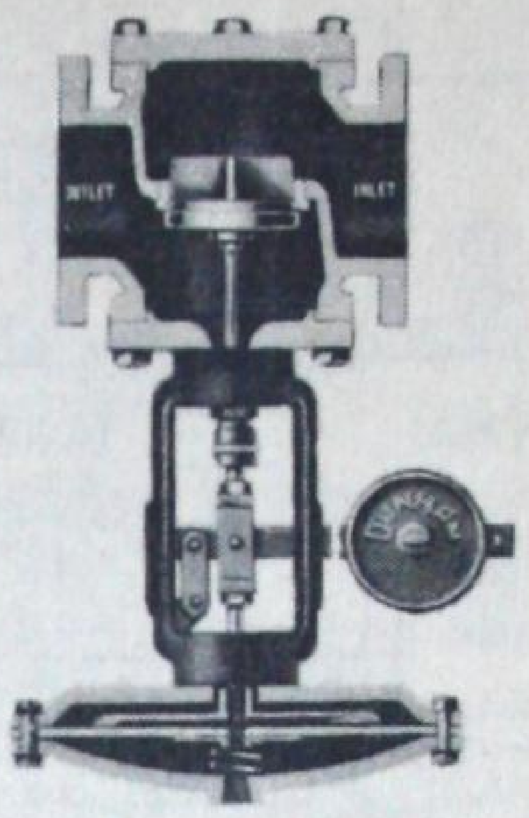
Dimension "H" is 25½" for all sizes.

Type 301 & 311

Sizes, dimensions and weights of Type 301 and 311 Valves are the same as for the Type 300 and 310 Valves respectively.

WORKING PRESSURES AND TEMPERATURES

Standard flanged connections up to 125 lb. initial pressure; screwed connections up to 250 lb. initial pressure; extra heavy flanged connections up to 250 lb. initial pressure. Maximum steam temperature of 500 degrees F. Reduced delivery pressures of 125 lb. and less.



Single-Seated Valve Section

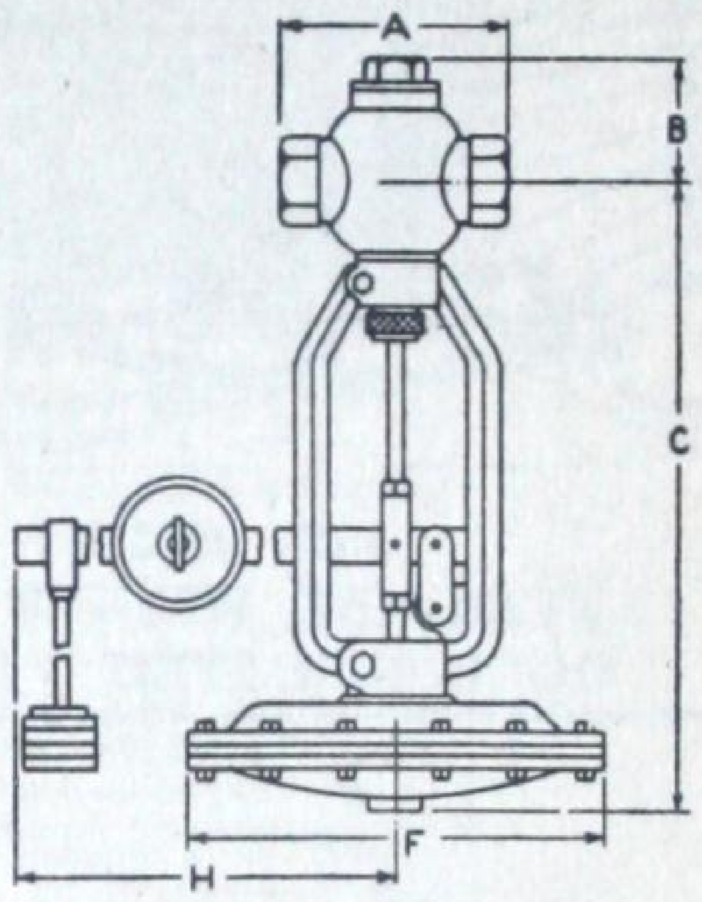


Fig. 2007

ORDERING

Orders should give Catalog No. or Type Number and size and the following information:

- **(a) Service—Steam or Air.**
- **(b) Initial Pressure.**
- **(c) Reduced Pressure. Various sizes of diaphragms are available to give the required reduced pressure of 125 pounds or less. The specific pressure should be stated because each size of diaphragm has a limited pressure range.**
- **(d) Weight of Steam or amount of EDR to be served or volume of Air to be delivered per hour.**
- **(e) Amount of Superheat, if any.**

Connections are right-hand female pipe thread or flanged as listed.

Companion flanges, bolts and gaskets are not included.

Inner valves and seats of monel metal are available on special order.

Control pipe should never be less than ½".

PARTS LIST AND REPAIRS

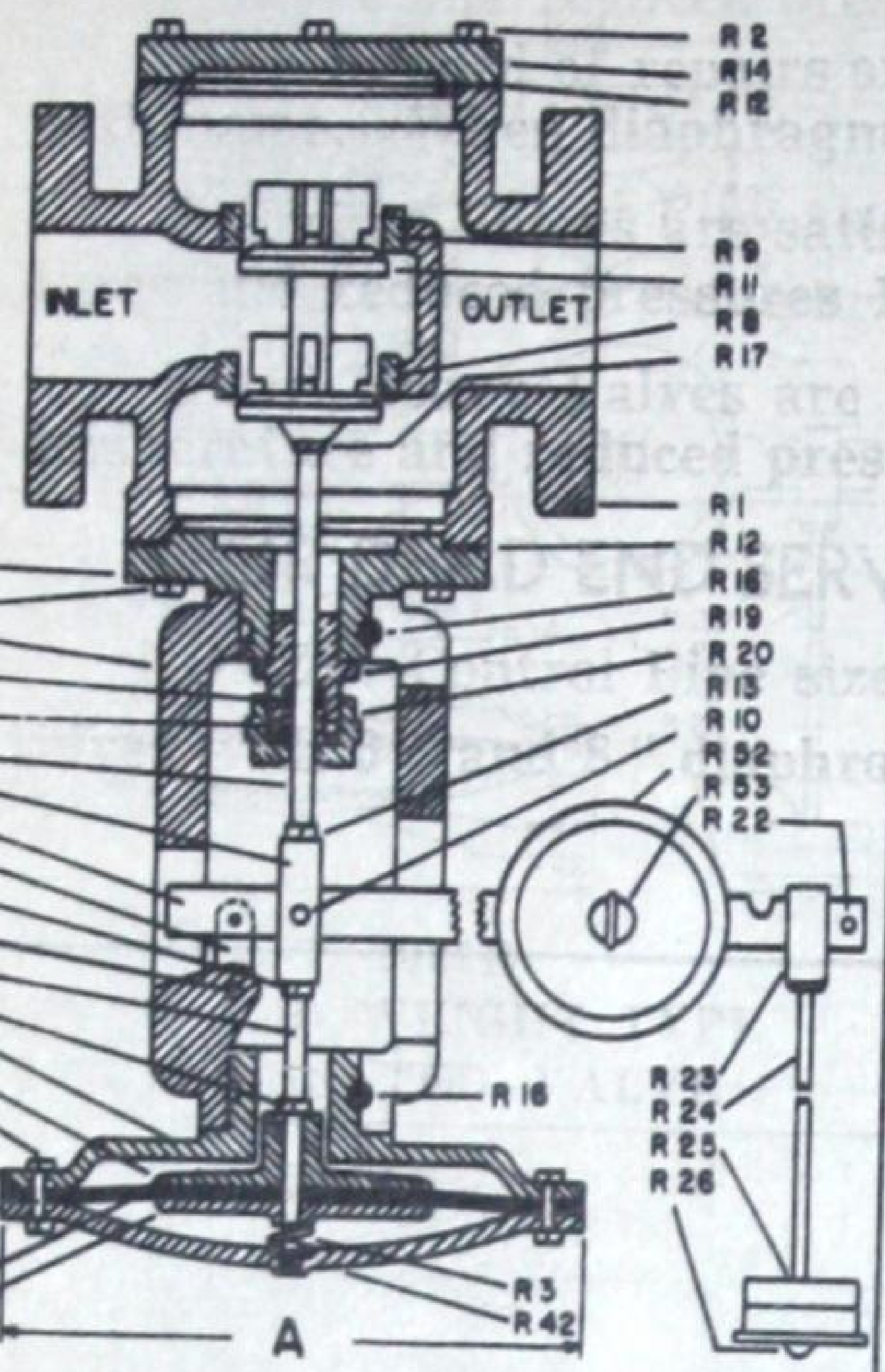


FIG. 2026B
LEVER AND WEIGHT TYPE
DOUBLE-SEATED VALVE

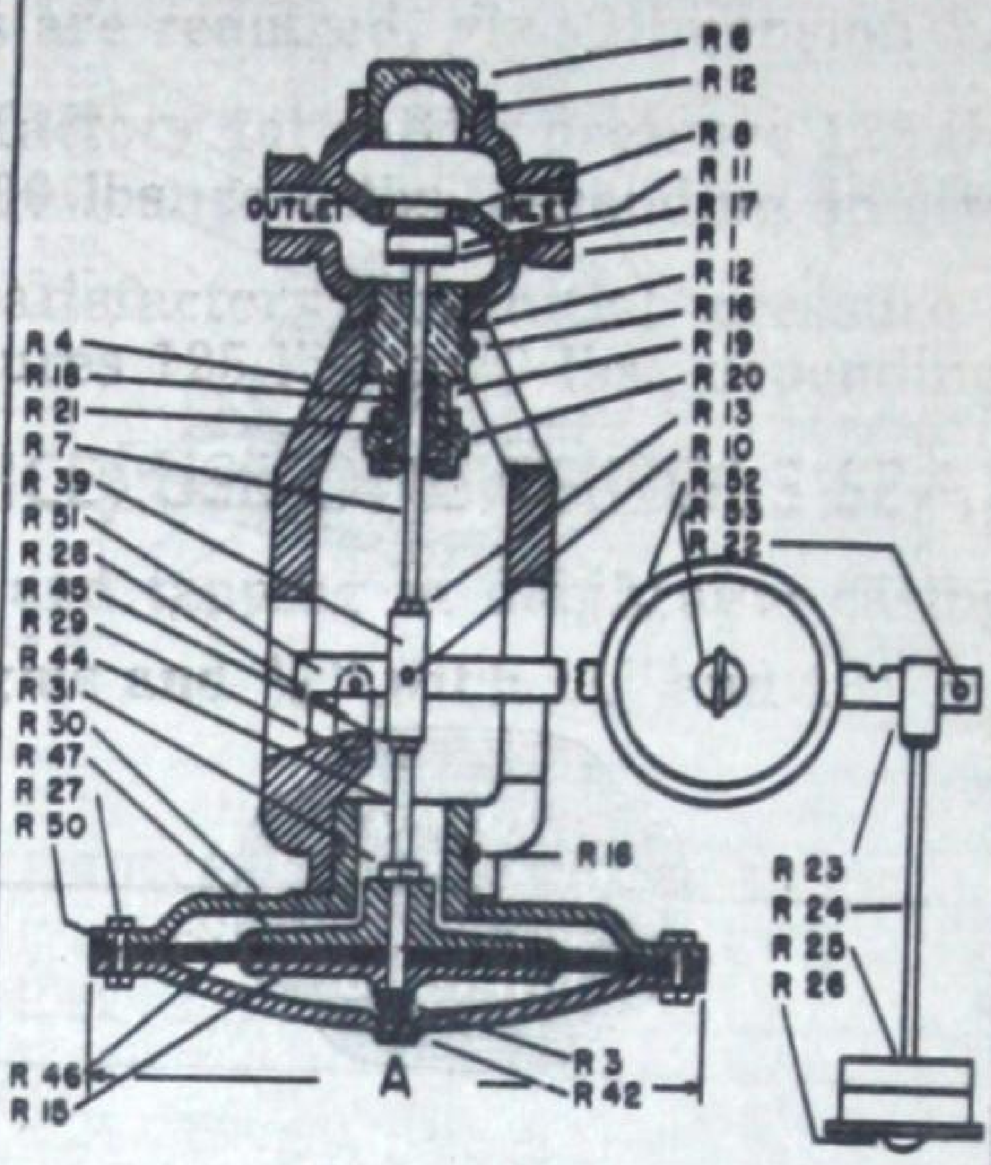


FIG. 2055
LEVER AND WEIGHT TYPE
SINGLE-SEATED VALVE

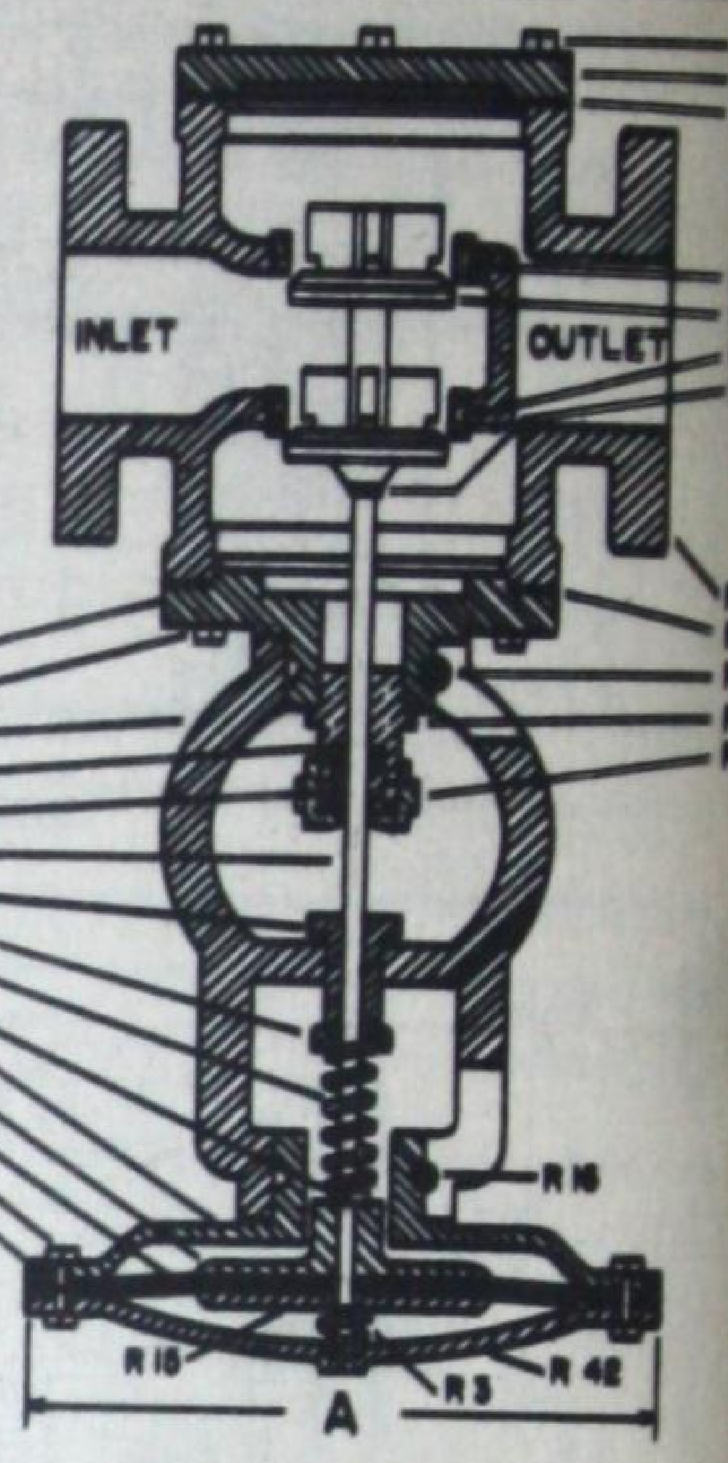


FIG. 2056
SPRING TYPE
DOUBLE-SEATED VALVE

PARTS LIST

R 1 —Body.
R 2 —Cap Screws.
R 3 —Diaph. Spring.
R 4 —Lever Yoke.
R 6 —Body Cap.
R 7 —x Valve Stem.
R 8 —Large Seat Ring.
R 9 —Small Seat Ring.
R 10—Yoke Pin.
R 11—x Valve.
R 12—Cover Gaskets.
R 13—Valve Stem Lock Nut.
R 14—Blind Flange.
R 15—Retaining Plate.
R 16—Lever Yoke Bolt.
R 17—x Valve Lock Nut.
R 18—Packing.

R 19—Stuffing Box.
R 20—Stuffing Box Nut.
R 21—Stuffing Box Gland.
R 22—Lever Pin.
R 23—Weight Rod Head.
R 24—Weight Rod.
R 25—Loose Weight.
R 26—Fixed Weight.
R 27—Diaph. Bolt Nut.
R 28—Link.
R 29—Link Pin.
R 30—Diaph. Casing.
R 31—Lock Nut.
R 39—Yoke, Valve Stem.
R 42—Diaph. Casing Cap.
R 44—Diaph. Stem.

R 45 —Lock Nut.
R 46 —Diaphragm.
R 47 —Diaph. Plate.
R 50 —Diaph. Bolt.
R 52 —Round Slide Weight.
R 53 —Thumb Screw.
R 104—Yoke.
R 105—Adjust. Screw.
R 106—Tension Plate.
R 107—Valve Stem.
R 108—Spring.
R 109—Diaph. Casing.

x R 7, R 11 and R 17 are assembled and trued up at Factory and must be used intact and not separately for Single-Seated Valves.

REPAIRS

When in need of repairs or information, send Serial Number, Valve Size and Part Number with name. When diaphragms are required, give Dimension "A".

Standard Valves are satisfactory for initial pressure 125 lbs. at saturated steam temperatures and reduced pressures 100 lbs. to 0 lbs., depending on size of the diaphragm.

Extra Heavy Valves are satisfactory for initial pressure 250 lbs. at saturated steam temperature and reduced pressures 125 lbs. to 0 lbs., depending on size of the diaphragm.

FOR DEAD END SERVICE, USE ONLY SINGLE SEATED TYPE OF VALVE

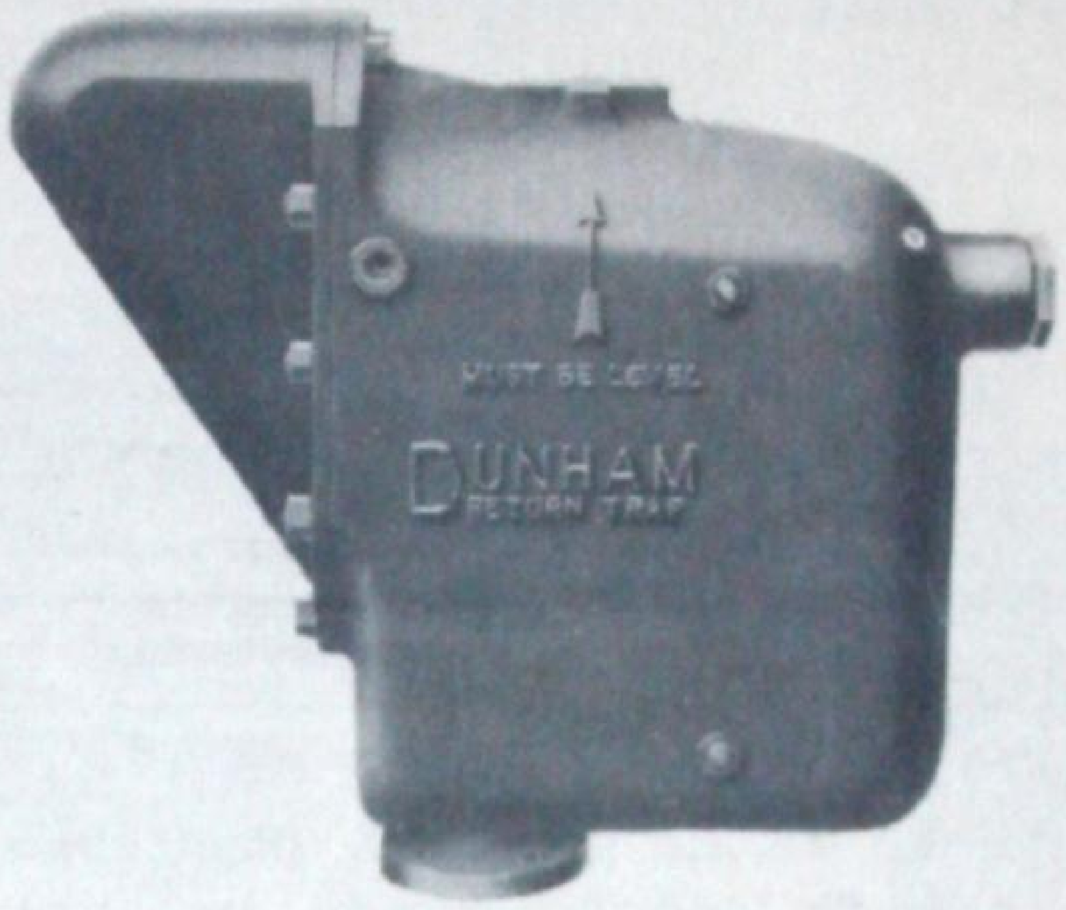
NOTE:—Control Pipe size and tapping in diaphragm casing is ½" on pressure reducing valves with 6" and 8" diaphragms and ¾" with 11" and 13" diaphragms.

DUNHAM RETURN TRAP

Nos. 9A AND 10A

This trap is designed to give positive return of condensate to low pressure boilers (15 pound limit) on gravity heating systems. Working parts are protected from dust and dirt yet are accessible without removing any piping. Its function is to separate the air and water discharged into the dry return piping by the Dunham Radiator Traps, to release the air, and to return the water to the boiler regardless of the pressure carried within the in boiler or system limit of 15 lb gauge.

The trap is made in two sizes all similar in operating principles, with slight variations in design and construction.



OPERATION

As boiler pressure increases above the point at which condensate will return to the boiler by gravity, the condensate rises into the body of the trap, lifting the float as the water level rises. When the float arm is raised sufficiently it causes a snap action mechanism to close the vent valve and open the steam valve simultaneously thus creating boiler pressure in the trap which causes condensate in the trap to flow back to the boiler. The float lowers with the water line in the trap automatically closing the steam valve and opening the vent

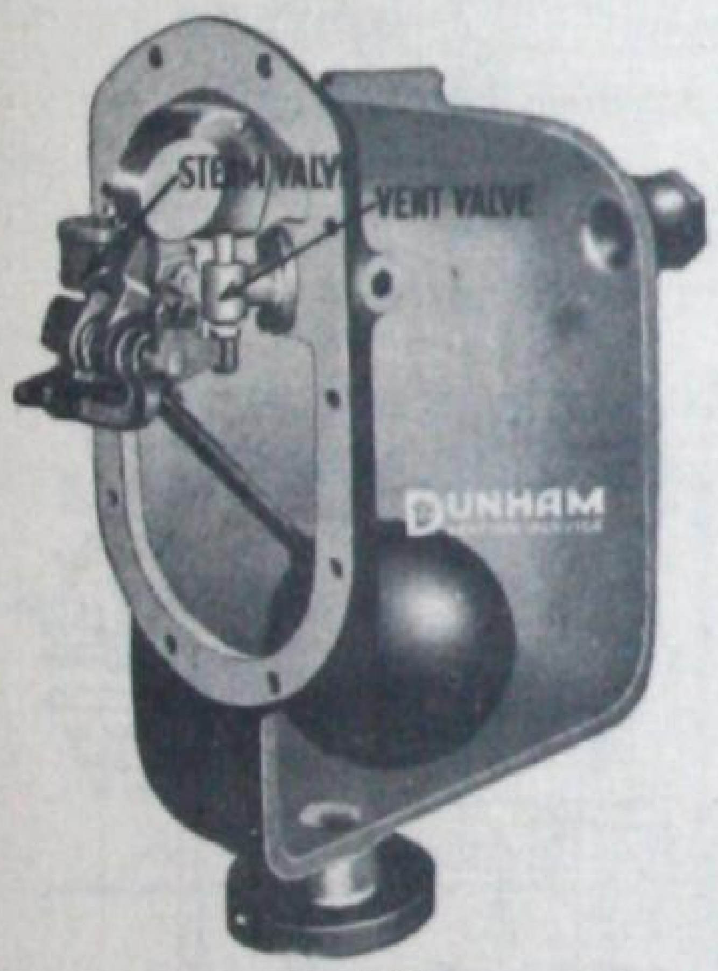


Fig. 933A

Return trap ready to fill. Steam valve closed, vent valve open.

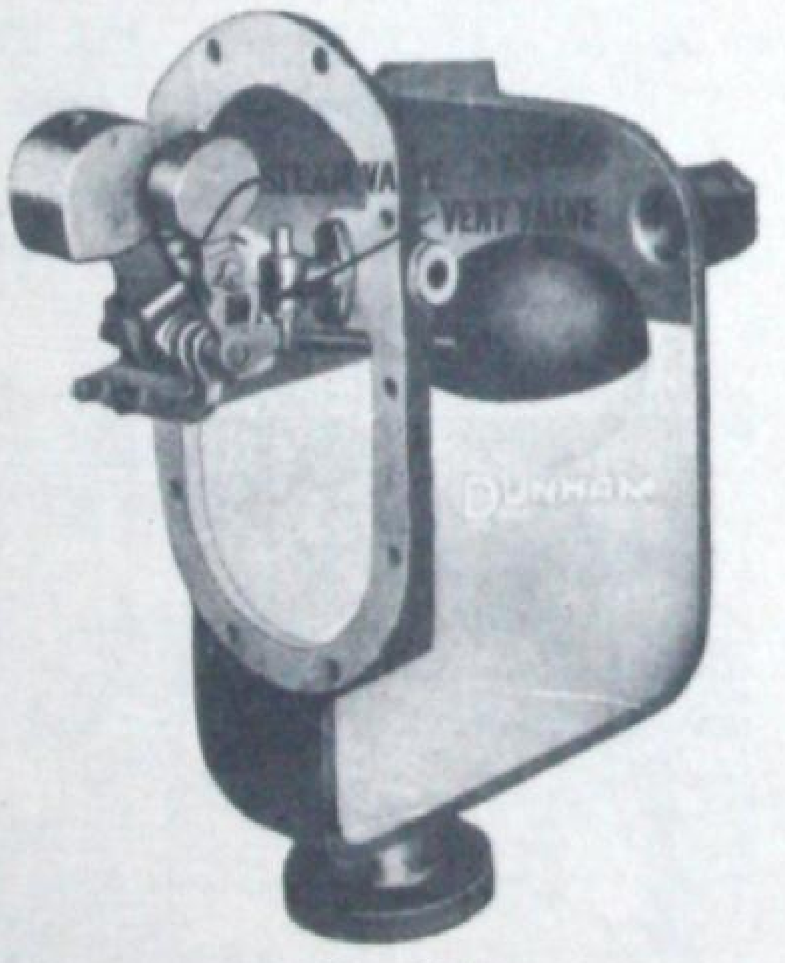


Fig. 934A

Return trap ready to discharge condensate to boiler. Steam valve open, vent valve closed.

No. 9A Trap has right hand female pipe tappings. Air Eliminator with Air Check is included with this trap. Connection II on No. 9A Trap is plugged as required for standard installation.

Trap 10A has right hand female tappings except Connection 1 which is standard flanged. It is furnished with 2″ reducing companion flanges, bolts and gaskets. Connection II is bushed to ¾″ as required for standard installation. Air Eliminator is included with this trap. Gauge Glass Set (⅜″) is available on special order. Return Trap is tapped for gauge glass connections. Specify Catalog Number or Type Number and size on order.

PARTS

When parts are required for Return Traps, we recommend mechanism be furnished complete and tested as a unit at factory before shipment. This method will assure proper functioning of the trap after repairs are completed. When ordering mechanism, please give complete type number cast on side of the trap.

CAPACITIES

Return Trap No.	Distance Between Boiler Water-Line and Bottom of Trap Inches	Capacity Square Feet Equivalent Direct Radiation
9 A	6	3000
	10	3400
	18	3600
	24	3800
	36	4000
10A	6	5000
	10	5400
	18	5600
	24	5800
	36	6000

DIMENSIONS

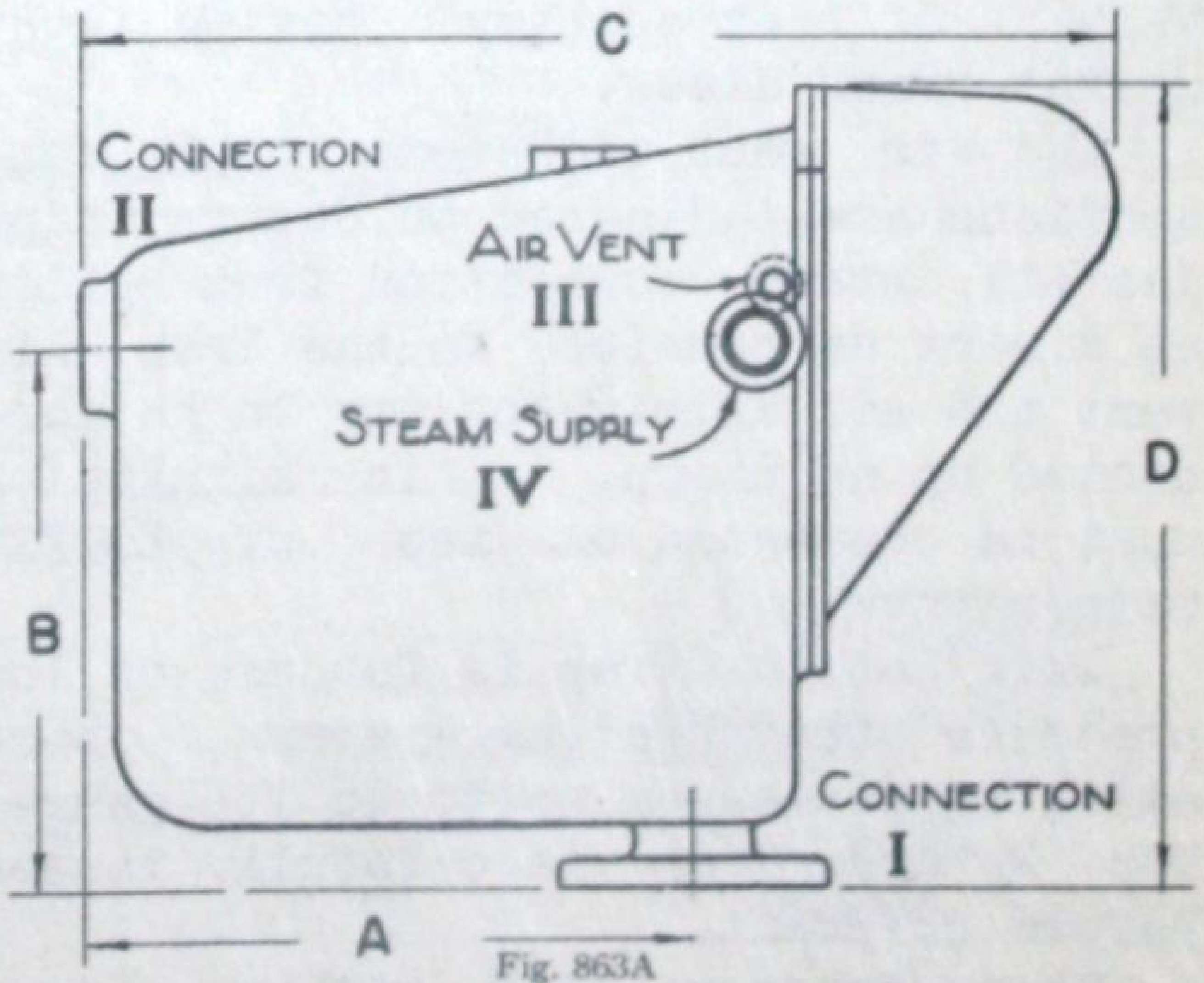


Fig. 863A

For operating pressures up to 15 lb gauge

Size No.	Cat. No.	Size Conn. In.				Shipping Weight Lb	Code	Dimensions in Inches				
		I	II	III	IV			A	B	C	D	Width Overall
9A	FR30	1½	1½	½	1	125	Renine	12¼	13⅜	23⅜	20	9¼
10A	FR50	2	2	½	1	155	Reten	13⅞	14½	25⅜	21¼	9¼

Replaces File No. 14H-3-1
Dated: Jan. 1, 1947

Can. File No. 14H-3-1
Date: May 1, 1949

INSTALLATION INSTRUCTIONS

DUNHAM RETURN TRAP

Nos. 9A AND 10A

To prepare Return Trap for installation, remove nuts or cap screws holding wood blocking in place. Also all wires holding mechanism in place for shipping.

Install return main as high above the Boiler water line as possible, consistent with good grade in direction of flow. THE RETURN TRAP MUST BE SET LEVEL, and the bottom of Trap at least six inches (6") above Boiler water line. If there is considerable head room between lowest return main and Boiler water line, then set Return Trap so that the levelling boss on top of the Trap is on a level with the bottom of lowest return main, where it drops to connect to inlet of Return Trap.

Install the Return Trap so it is accessible for inspection. Install discharge of Trap to Boiler free from unnecessary elbows. Use Swing Check Valves of best quality, having light weight brass discs.

The air vent and steam supply connections are indicated on Return Trap. Install steam connection from Boiler as direct as possible to the Trap. Air vent and Air Eliminator are to be connected up as shown. Air Eliminator must be connected on top of LOWEST main return.

This Return Trap is for use on low pressure steam heating systems, operating on pressures up to 15 lbs. gauge. The Return Trap is carefully tested before shipment.

When corresponding with us on any matters regarding Return Traps, always refer to the number and letter, if any, on side of Trap.

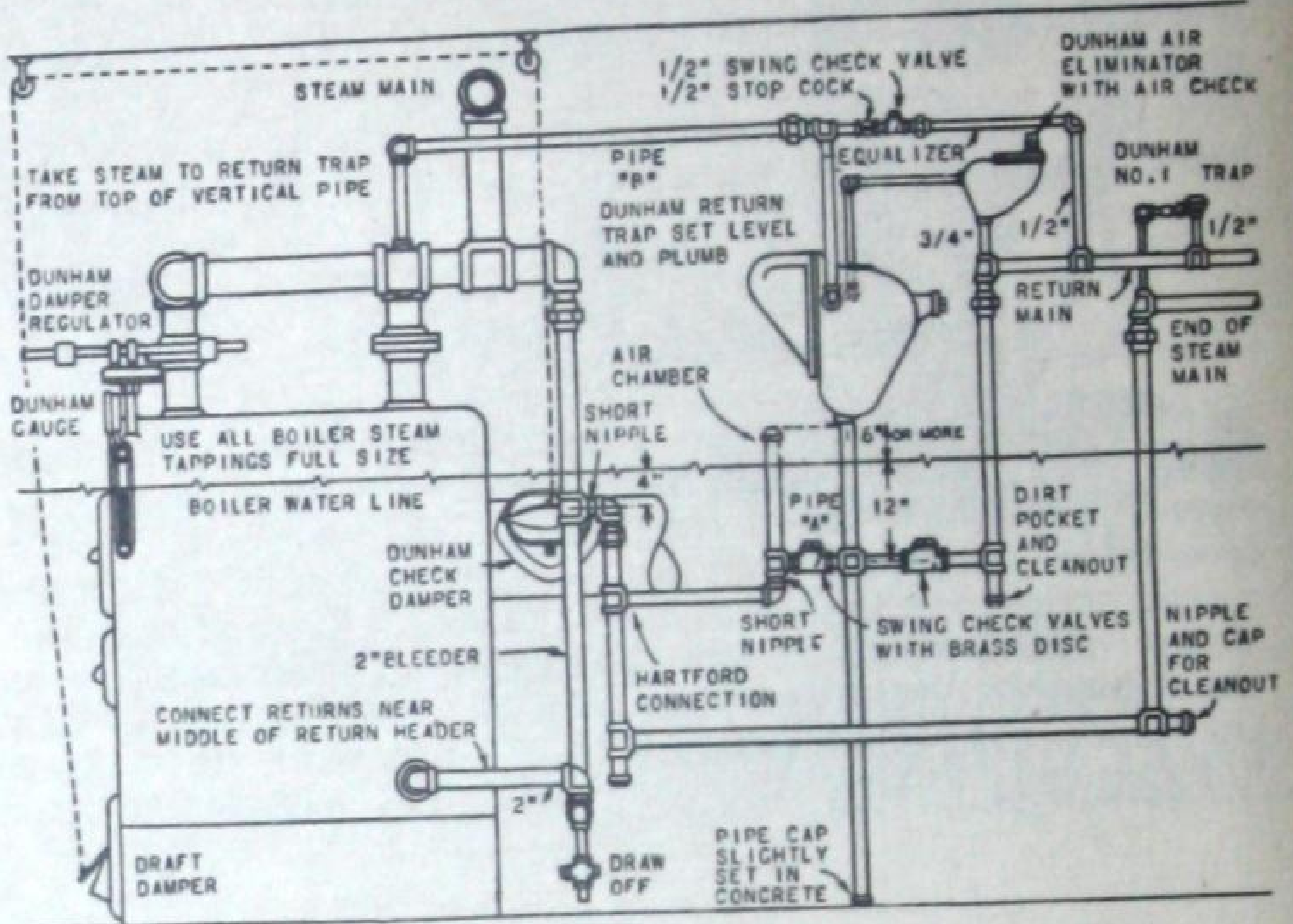


Fig. 3000 A

Typical boiler connections for Dunham Return Trap 9A

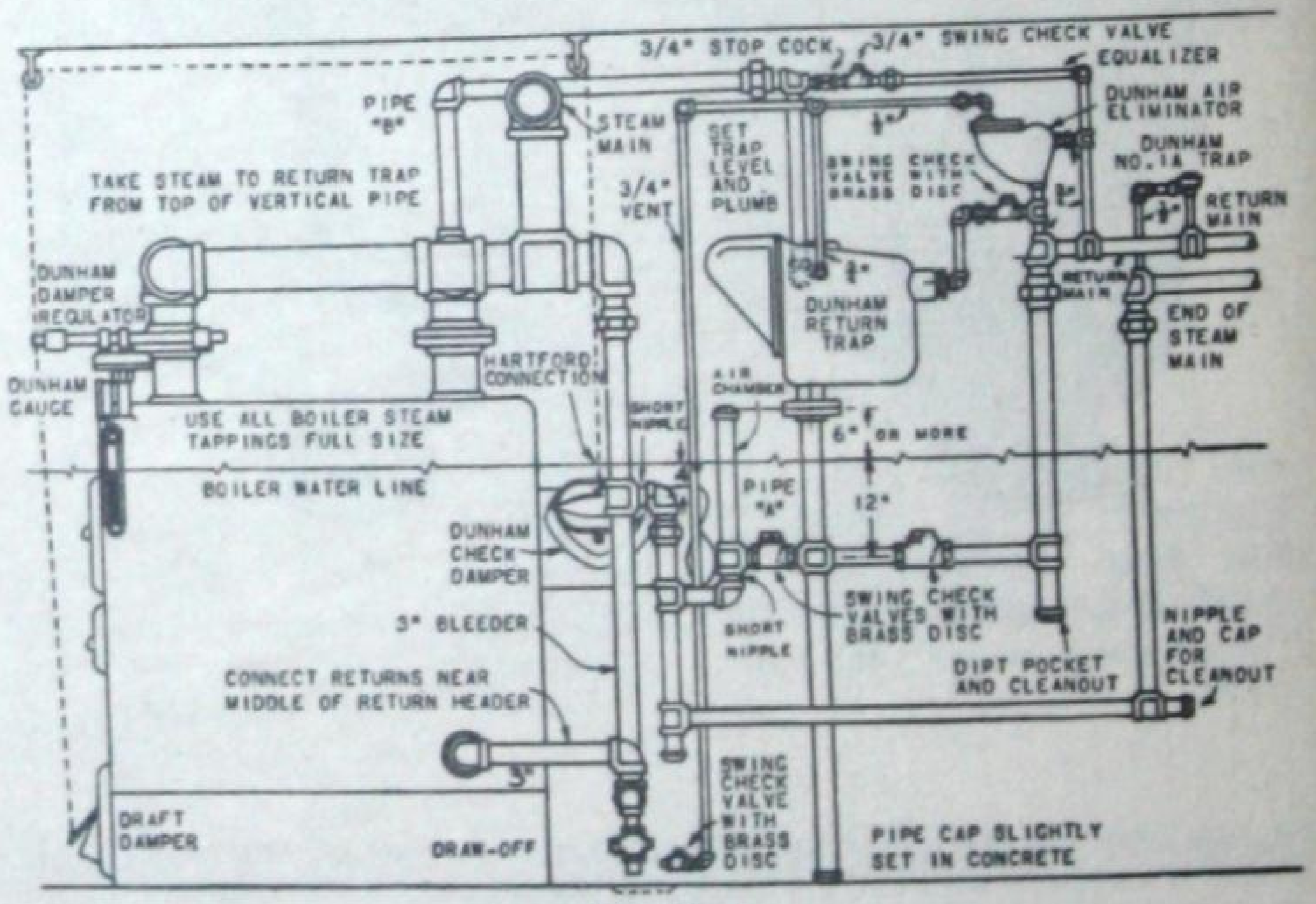


Fig. 963C

Typical boiler connections for Dunham Return Trap 10A

Size of Trap	Size of Pipes		Minimum Height Bottom of Trap to Bottom of Return Main
	"A"	"B"	
9A 10A	1½" 3"	1¼" 1¼"	18" 20"

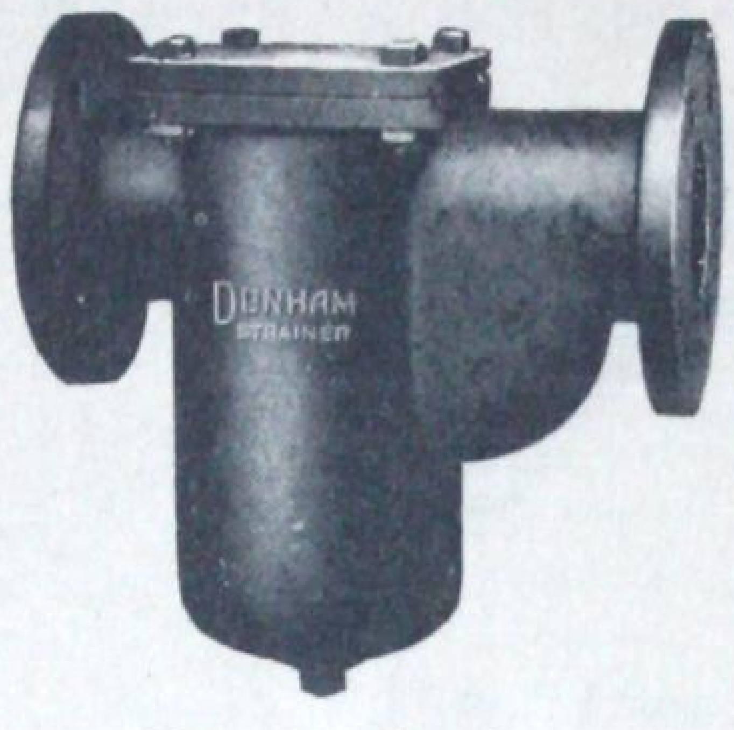
THE DUNHAM STRAINER

TYPE 210

NOT RECOMMENDED FOR STEAM LINES UNLESS PROPERLY DRIPPED

The Dunham Type 210 Strainer is simple in design, of liberal area and free from an internal water seal. There is a free passage through the Strainer to the point of release.

This strainer is built of the best soft grey iron casting, heavy and durable, for service with pressures up to 60 pounds. The cover and sediment basket are easily removable. The basket is of 22 gauge brass sheet having .079 inch diameter holes, 81 holes to the square inch. The basket has a cast base and top rim. When in position in the Strainer, the top rim of the basket rests upon a flange in the body casting so that the flow is into the basket which catches and holds all scale, sediment or other foreign matter while the water passes through the perforations.



Type 210 Strainer

Fig. 851—Basket of Type 210

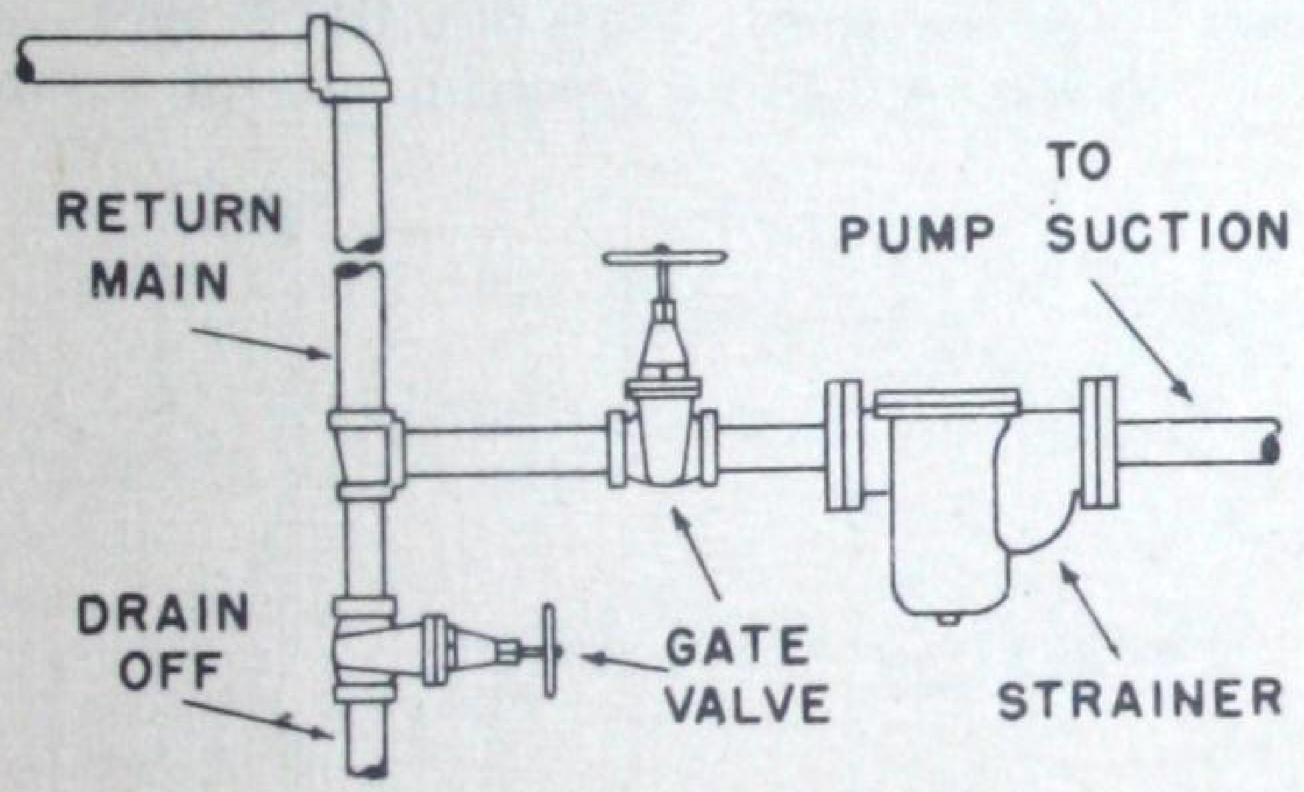


FIG. 2080

USE OF STRAINER ON RETURN LINE

Specify Catalog No. and or Type No. and size on order.

. . .

Code for removable basket only: Add prefix "Ba" to strainer code of correct size.

APPLICATIONS

The function of the Strainer is to prevent passage of dirt, scale, chips or other foreign matter into appliances in which they might cause wear or reduce operating efficiency. The Type 210 Strainer is particularly adapted for use ahead of vacuum pumps and condensation pumps on heating or process systems and also ahead of centrifugal pumps on some types of service. It can also be used to advantage on the system side of the check valve at the inlet connection of a Return Trap on gravity steam heating systems to prevent trash working into the check valve and the Return Trap mechanism.

The Strainer basket should be removed at frequent intervals and the accumulated sediment removed. On heating systems this is specially important during the first season of operation when there is usually much foreign matter to be removed before the system becomes fully efficient.

For Operating Pressures up to 60 Pounds

Cat. No.	Size Inches	Net Wt. Lbs.	Code	Dimensions in Inches				
				A	B	C	D	Overall Width
SBF2½	2½	50	Leaky	2½	7	12 11/16	9	7
SBF3	3	55	Lemon	3	7½	12 11/16	9	7½
SBF4	4	86	Legion	4	9	15 ½	10⅝	9
SBF5	5	123	Lever	5	10	17 ⅞	13	10
SBF6	6	145	Lettuce	6	11	20	14¾	11

Type 210 Strainers have standard flanged connections. Companion flanges, bolts and gaskets are not included. Where smaller strainers are required, Dunham Type 211 "Y" Strainers in sizes from ½″ to 2″ are recommended.

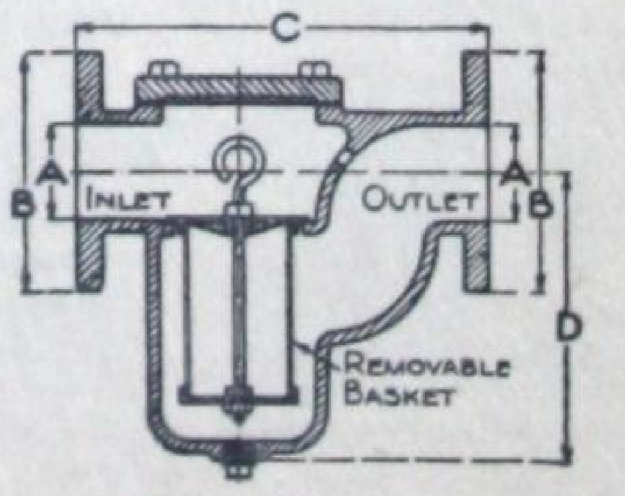


Fig. 853A
Type 210

Replaces File No. 14J-3-1
Dated: June 6, 1940

Can. File No. 14J-3-1
Date: May 1, 1949

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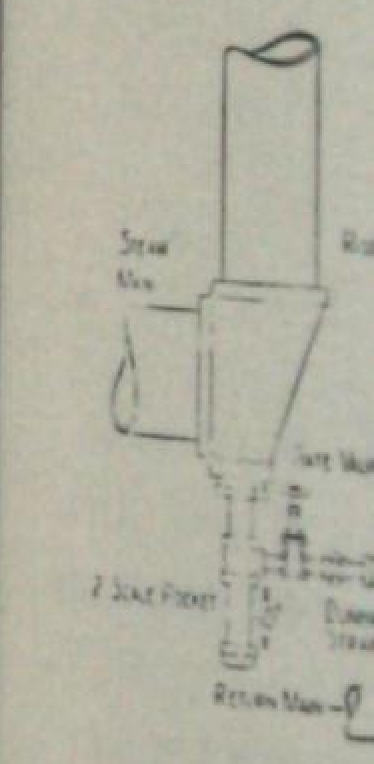
DUNHAM
Vari-Vac
DIFFERENTIAL
HEATING

This Strainer
sediment and
heating system
time would int
impair the effic
trapped and rea
provides liberal
water seal thus
point of release.

APPLICATION

The "Y" Stra
to prevent pass
trap. Figs. 924
strainers in the



Strainers are
thermostatic tra
to unit heaters
They are also
pressure traps a
water or gas.

Type 211 Strai
connections.

Add prefix "Ba
lish code for remo
Sieve only for $\frac{3}{4}$"

Replaces File No.
Dated:
June

THE DUNHAM "Y" STRAINER

TYPE 211

This Strainer is designed to catch dirt, scale and sediment and permit their removal from steam heating systems. This foreign matter, which in time would interfere with circulation and might impair the efficiency of mechanical equipment, is trapped and readily removed. The design is simple, provides liberal flow area and prevents an internal water seal thus maintaining a free passage to the point of release.

Type 211 Strainer and Sieve

APPLICATIONS

The "Y" Strainer is installed ahead of drip traps to prevent passage of dirt, scale and rust into the trap. Figs. 924B and 925B illustrate this use ot strainers in the dripping of steam mains.

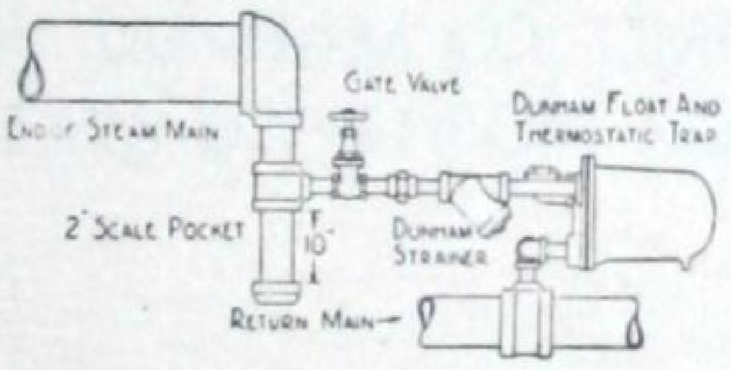


Fig. 925B
Method of dripping end of steam main

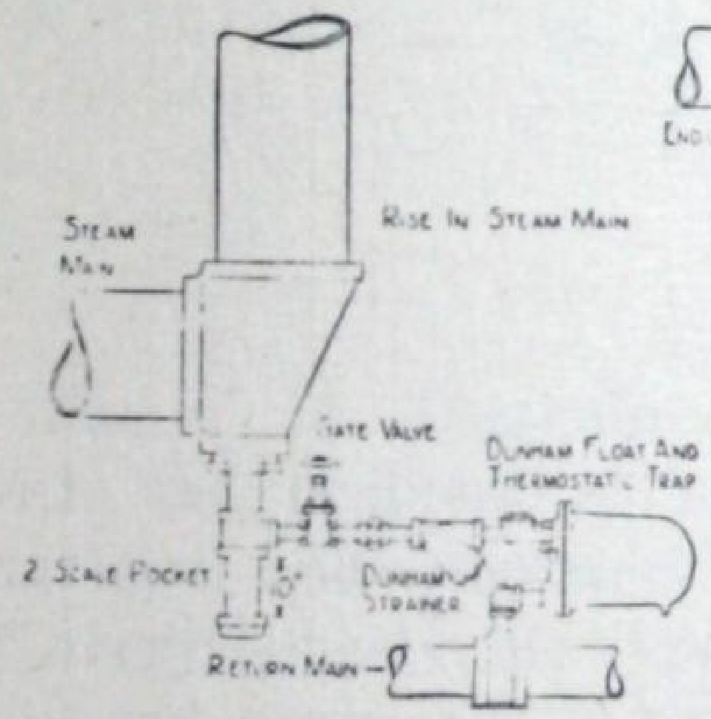


Fig. 924B
Method of dripping rise in steam main

Strainers are used ahead of float and thermostatic traps as applied to process apparatus, to unit heaters and to blast radiators.
They are also used ahead of medium and high pressure traps and pressure regulators for steam, water or gas.

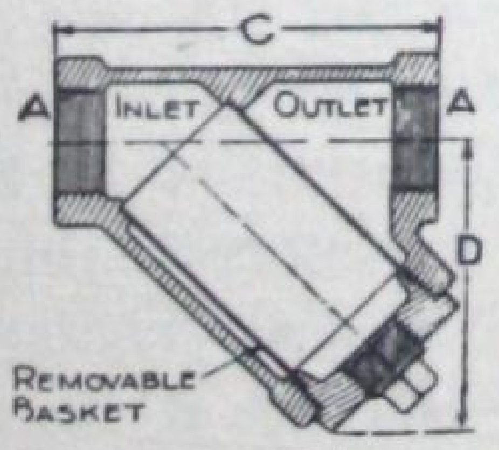


Fig. 891A
Type 211 Strainer

Type 211 Strainers have right hand female pipe tapping connections.

Add prefix "Ba" to strainer code of correct size to establish code for removable sieve only. Example: Balaugh = Sieve only for ¾" Type 211 Strainer.

CONSTRUCTION

This strainer is built of the best soft grey iron casting, heavy and durable, with easily removable cover and sieve. The sieve is of 22-gauge brass sheet having .079-inch diameter holes, 81 holes to the square inch. The sieve is inserted from the bottom and held in position by recesses in the body casting and plug. All sizes have right hand female pipe tappings.

CARE

The strainer sieve should be removed frequently to extract accumulated sediment. This is particularly important during the first heating season when there is usually much foreign matter to be removed before the system becomes thoroughly clean.

Type 211 Strainer Data
For Operating Pressures up to 125 Pounds

Size Inches	Catalog No.	Net Weight Lb	Code	Dimensions in Inches			
				A	C	D	Overall Width
½	SS½	3	Laudable	½	4½	3½	2¾
¾	SS¾	2⅞	Laugh	¾	4¼	3½	2¾
1	SS1	3¼	Laundress	1	4¾	3⅞	2¾
1¼	SS1¼	5	Laurel	1¼	5⅝	4¼	3¼
1½	SS1½	8¼	Laureate	1½	5⅞	4¼	3¼
2	SS2	16¼	Lavatory	2	8⅛	5¼	4½

Specify Catalog Number or Type Number and Size on order.

Where larger flanged strainers from 2½" to 6" in size are required for use ahead of vacuum pumps or boiler return traps and pumps, Dunham Type 210 Strainers are recommended.

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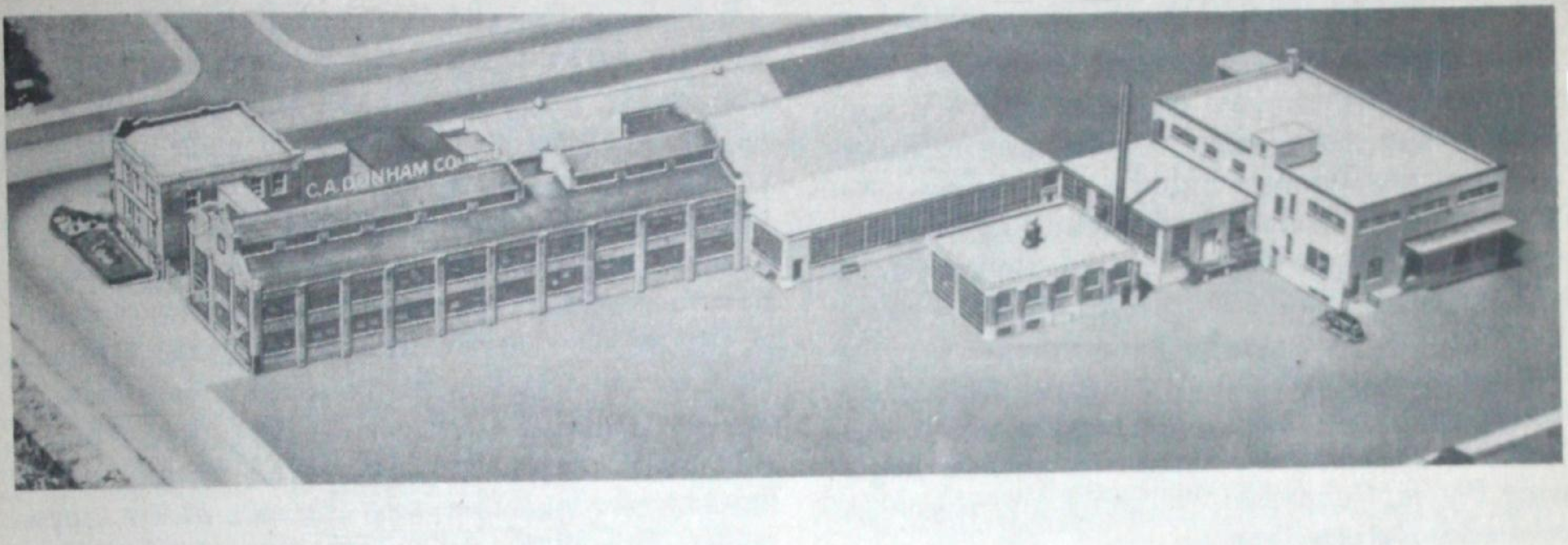

C. A. DUNHAM CO. LIMITED, HEAD OFFICE AND PLANT
1523 DAVENPORT ROAD, TORONTO 4, ONTARIO

The C. A. Dunham Co. Limited is engaged with the problem of making steam an easily managed and economical servant in the heating of every conceivable type of building. The accumulated experience of the entire Dunham organization is put at your disposal through its Sales Offices for engineering counsel in correct selection of heating equipment located at Calgary, Halifax, Montreal, Ottawa, Quebec, Sherbrooke, Toronto, Vancouver and Winnipeg.

This Company officially began business in 1910, the Head Office and the first section of the plant were built in 1912. It had its origin in one product, the Dunham Fluid Thermostatic Radiator Trap. The plant has gradually been expanded to permit the manufacture of a complete line of steam heating equipment and heating systems.

THE DUNHAM DIFFERENTIAL SYSTEM

The Dunham Differential Vacuum Heating System is a simple two-pipe system using steam at variable pressures and temperatures to balance the heat loss from a building under changing weather conditions. The rate of steam supplied to the system is controlled to permit the heat output to balance the demand. The Dunham Company manufactures all of the appliances required to co-ordinate the control, circulation, distribution and heat supply including Control Devices, Thermostatic Traps, Float and Thermostatic Drip Traps, Bellows Packless Valves with Regulating Plates and Vacuum and Boiler Feed Pumps with Differential Controllers.

THE DUNHAM VACUUM RETURN SYSTEM

The Dunham Vacuum Return Line Heating System is a two-pipe system employing atmospheric pressure or higher in the steam supply piping and radiation and a partial vacuum in the return piping to ensure positive circulation. It is used for installation in which temperature regulation is not a primary consideration. The Dunham Company manufactures all of the appliances required including Thermostatic Traps, Float and Thermostatic Drip Traps, Valves with Regulating Plates and Vacuum and Boiler Feed Pumps.

THE DUNHAM GRAVITY RETURN SYSTEM

The Dunham Return Heating System is a two-pipe system employing pressures above atmosphere in the steam supply piping and radiation to ensure positive circulation and utilizing a Return Trap or Condensation Pump and Receiver to return the condensate to the Boiler. It is used for small installations in which temperature regulation is not a primary consideration. The Dunham Company manufactures all of the appliances required including Thermostatic Traps, Float and Thermostatic Traps, Valves with Regulating Plates, Condensation Pumps and Receivers and Boiler Return Traps.

DUNHAM STANDARD PRODUCTS

STANDARD HEATING APPLIANCES for Vacuum Return Line and Gravity Steam Heating Systems, Pressure Reducing Valves—Lever and Weight Type, for both heating systems and industrial applications.

PUMPS, low pressure, electric motor driven for both Gravity Return and Vacuum Return Line Heating Systems.

STRAINERS for use with Float and Thermostatic Drip Traps.

TRAPS, Thermostatic Traps for Radiators, Float and Thermostatic Traps for low-pressure heating systems; Thermostatic Traps for medium-pressure service and Inverted Bucket Traps for high-pressure service.

UNIT HEATERS for space heating, low and high pressure with either horizontal or vertical air flow.

CONVECTOR RADIATORS for floor or wall mounting with easily removable fronts for exposed or partially recessed installations or metal front Convectors for completely recessed installation.

GUARANTEE

We warrant apparatus manufactured by us to be free from defects in material and workmanship under normal use and service; our obligation under this Warranty being limited to making good at our factory any part or parts thereof which shall within one year after delivery of such apparatus to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been defective. This Warranty is expressly in lieu of all other Warranties expressed or implied and of all other obligations or liabilities on our part—and we neither assume or authorize any other person to assume for us any other liability in connection with the sale of our apparatus. This Warranty does not cover any labour charges for replacement of parts, adjustments, repairs or any other work done. This Warranty shall not apply to any apparatus which shall have been repaired or altered outside of our factory in any way, so, as in our judgment, to affect its serviceability now which has been subject to negligence, misuse or pressure in excess of stated limits.

NOTE: Dunham Heating Systems and products are being constantly improved. In order that the benefit of these improvements may be made available to the public without delay, this Company reserves the right to change details of design at any time without notice.

RETURN OF MATERIAL

Shipping instructions must be obtained from the Head Office before returning any material for credit. All shipments must be prepaid. A memorandum of the materials returned with the name of the job from which they came, should be enclosed with shipment. Shipper's name and address should be marked on each box to facilitate identification on arrival at our plant.

All material returned is subject to a minimum handling charge of 10% and if used or damaged, additional charge will be determined by condition of material when received and inspected at the factory.

A LABOR-SAVING MEANS TO CALCULATE OR CHECK RADIATION

THE following means to determine or check radiation requirements, *properly applied, gives accurate results and saves from one-half to two-thirds of the time usually required* for calculations on ordinary types of building construction such as is found in dwellings, apartments, offices and similar structures. It is based on the recommended Btu method. In brief, the dimensions of exposed walls and of windows are converted directly into radiation without calculation of wall area or glass area. The radiation amounts given in the tables are based on a temperature of 70° F. inside and 0° F. outside, using the following coefficients of heat transmission per degree difference of temperature per hour:

For Windows and Glass	1.00 Btu
For Walls	0.25 Btu
For One Sq. Ft. Equivalent Direct Radiation	240 Btu

Method of Using Tables

A sample calculation reveals the simplicity of the method. Two typical rooms, one a corner room and the other exposed on one side only, are shown in Fig. 1628. Where more than two sides of a room are exposed, the method is similar to that used for a room exposed on two sides. The data sheet used is suggested as a suitable form of working sheet. Radiation requirements for wall above and below windows may be recorded in the column "For Wall Above and Below Windows." The engineer may prefer to make a separate calculation instead of an approximation by adding one-half or one-third of the width of windows to the lineal feet ofwall.

Radiation for Room 101

FOR WINDOWS TABLE I

Follow vertical column under "Width of Glass" down to figure 32" (the width of first window in Room 101). Then follow table horizontally out to column headed 30" (the height of window in Room 101). Note that 7.22 sq. ft. of equivalent direct radiation are required. The two identical windows double this requirement to 14.44 sq. ft. of radiation. This is recorded on working sheet in column "For Windows" under "Radiation."

FOR WALLS TABLE II

The lineal feet of wall is 20½ feet. To compensate for wall above and below windows, add one-half the width of windows to the above running feet of wall. (Other factors may be used as plans warrant.) This gives a total length of wall of 20½ ft. + 3 ft. or 23½ ft. The ceiling height is 9 feet.

Follow vertical column "Height of Ceiling or Width of Room" down to figure 9'. Then follow table horizontally out to column headed 24' ("Running feet of exposed wall"). Note that 23.63 sq. ft. of radiation are required. This is recorded on working sheet in column "For Total Wall" under "Radiation."

While the above method is accurate for practical purposes, it may be desired to make a separate calculation of radiation required to compensate for walls above and below windows. In the Room 101 the area above and below the two windows would be 6' x 4½'. The amount of radiation would be indicated at the intersection of the 9' Height and 6' Width columns as 5.91 sq. ft., divided by 2, or 2.95 sq. ft., which would be recorded under "For Wall Above and Below Windows" and added to the radiation required for 21 feet of exposed wall (20.68 sq. ft.), giving a total radiation for walls of 23.63 sq. ft. by this method.

Net radiation for Windows and Walls:

14.44 + 23.63 sq. ft. = 38.07 sq. ft.

Assuming in this sample calculation that no allowances are required for the wall transmission factor of 0.25 Btu, for leaky building construction, cold floor, ceiling or adjacent rooms, or for a design basis other than 0° F., there still remains an allowance for exposure to be added.

Multiplying the net radiation by the factor .30 for Northwest exposure as listed gives 11.42 sq. ft. of radiation, which is recorded in the column "Added for Exposure."

The "Total Radiation Required" for Room 101 is thus 38.07 + 11.42 or 49.49 sq. ft.

Similarly, Room 102 is found to require 28.96 sq. ft. of radiation.

Allowance for Exposure

Multiply net radiation by the following factors to obtain allowance for exposures:

North	35%	.35 factor
Northeast	25%	.25 "
East	15%	.15 "
Southeast	7.5%	.07 "
South	0	.00 "
Southwest	12.5%	.12 "
West	25%	.25 "
Northwest	30%	.30 "

Where prevailing winds and climates vary, changes should be made in the above allowances to make them conform with local conditions.

Correction Factors

The use of this tabular method is not limited to the conditions of the sample calculation. Allowances for other types of building construction, leaky construction and other design base temperatures are as follows:

For Other Types of Building Construction

It is usually necessary to correct only for the transmission factor through walls. This is done by multiplying the radiation obtained in Table II by the ratio of the transmission factor used to the transmission factor of 0.25 upon which the Table is based. Thus if the coefficient of heat transmission for the wall construction of a building is 0.29, it is necessary to multiply the radiation given in Table II by $\frac{29}{25}$ or by 1.16.

For Leaky Construction

The Tables contemplate good construction with moderately tight windows. If construction is loose, multiply the sum of the radiation obtained from Tables I and II (net radiation) by whichever of the following factors is required:

Loose Construction	1.07 or 1.13
Casement or French Windows or doors opening outside	1.07
Factory Bldgs., large amounts of glass with steel window frames	1.13 or 1.20
Corridors and vestibules	1.33 or 1.66

For Other Design Base Temperature

Add the amounts obtained from Tables I and II (net radiation) and then correct for temperature difference by multiplying by the proper factor from the following table:

Outside Temp.	Inside Temp.	Temp. Diff.	Multiplier Factor
—30°	70°	100°	1.43
—20	70	90	1.29
—10	70	80	1.14
+ 5	70	65	.93
+10	70	60	.86
+20	70	50	.72
+30	70	40	.57

For Cold Ceiling, Floors or Adjacent Room

Follow the same method as for exposed wall, using the ratio of temperature difference to correct for the temperature on the cold side and the ratio of coefficients of transmission to compensate for construction.

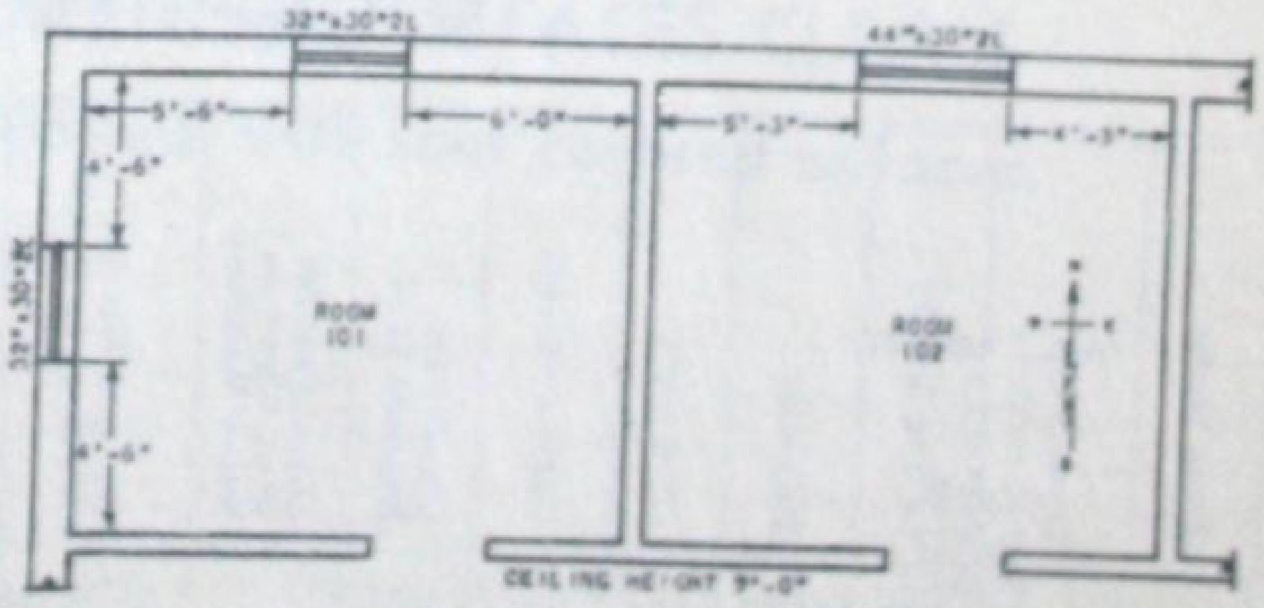

Fig. 1628

TABLE I

Square Feet of Equivalent Direct Radiation for Heat Loss Through Two-Pane Windows Including Sash
Room Temp., 70°F. Outside Temp., 0°F.

Width of Glass	Width of Opening	Height Glass	16″	18″	20″	22″	24″	26″	28″	30″	32″	34″	36″	38″	40″	42″	44″
			HEIGHT OF WINDOW OPENING IN FEET AND INCHES														
		Height of Opening	3′-2″	3′-6″	3′-10″	4′-2″	4′-6″	4′-10″	5′-2″	5′-6″	5′-10″	6′-2″	6′-6″	6′-10″	7′-2″	7′-6″	7′-10″
16″	1′—8″	STANDARD SIZES OF TWO-LIGHT WINDOWS	2.32	2.54	2.80	3.06	3.28	3.54	3.76	4.03	4.24	4.51	4.73	4.99	5.21	5.47	5.69
18″	1′—10″		2.54	2.80	3.06	3.33	3.63	3.89	4.16	4.42	4.68	4.94	5.21	5.47	5.73	5.99	6.26
20″	2′—0″		2.76	3.06	3.37	3.63	3.94	4.24	4.51	4.81	5.12	5.38	5.69	5.99	6.26	6.56	6.83
22″	2′—2″		3.02	3.33	3.63	3.94	4.24	4.59	4.90	5.21	5.51	5.86	6.17	6.48	6.78	7.09	7.48
24″	2′—4″		3.24	3.59	3.89	4.24	4.59	4.94	5.29	5.60	5.95	6.30	6.65	6.96	7.31	7.66	8.01
26″	2′—6″		3.46	3.85	4.20	4.59	4.94	5.29	5.64	6.04	6.39	6.74	7.13	7.48	7.83	8.23	8.58
28″	2′—8″		3.59	4.07	4.46	4.86	5.25	5.64	6.04	6.43	6.83	7.22	7.57	7.96	8.36	8.75	9.14
30″	2′—10″		3.94	4.33	4.77	5.16	5.60	5.99	6.39	6.83	7.22	7.66	8.05	8.49	8.88	9.28	9.71
32″	3′—0″		4.16	4.59	5.03	5.47	5.91	6.34	6.78	7.22	7.66	8.09	8.53	8.97	9.41	9.84	10.28
34″	3′—2″		4.38	4.86	5.29	5.78	6.26	6.69	7.18	7.61	8.09	8.53	9.01	9.45	9.93	10.41	10.85
36″	3′—4″		4.64	5.12	5.60	6.08	6.56	7.04	7.53	8.01	8.53	9.01	9.49	9.98	10.46	10.94	11.42
38″	3′—6″		4.86	5.38	5.86	6.39	6.91	7.39	7.92	8.44	8.93	9.45	9.98	10.50	10.98	11.46	11.99
40″	3′—8″		5.08	5.60	6.17	6.69	7.22	7.74	8.31	8.84	9.36	9.89	10.41	10.98	11.51	12.03	12.56
42″	3′—10″		5.29	5.86	6.43	7.00	7.57	8.09	8.66	9.23	9.80	10.33	10.89	11.46	12.03	12.60	13.13
44″	4′—0″		5.56	6.13	6.69	7.31	7.88	8.44	9.06	9.63	10.24	10.81	11.38	11.99	12.51	13.13	13.69

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Rules for Using Tables

1. Determine window dimensions or masonry opening for each window from plans and select the required radiation from Table I. If there are outside doors in the room, handle the same as for windows.
2. Measure the lineal feet of exposed wall plus *one-half of the sum of the widths of all windows from the plans and obtain the radiation required for the given ceiling height from Table II.

*This allowance for windows is approximate but is sufficiently accurate and on the safe side. If greater accuracy is desired, determine the width which gives proper value and add that fraction of the sum of the widths of all windows. Thus, this value may be 1/4, 1/3, etc.

3. Add the amounts of radiation obtained for windows and walls together to give the "Net Radiation" and correct this for exposures and other allowances.

TABLE II

Square Feet of Equivalent Direct Radiation for Heat Loss Through Wall Area of Various Dimensions
Room Temp., 70°F. Outside Temp., 0°F.

Height of Ceiling or Width of Room in Feet	RUNNING FEET OF EXPOSED WALL WITHOUT REGARD TO WINDOW OPENINGS																		
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
8	5.25	6.13	7.00	7.88	8.75	9.63	10.50	11.38	12.25	13.13	14.00	14.88	15.75	16.63	17.50	18.38	19.25	20.13	21.00
8½	5.58	6.56	7.44	8.42	9.30	10.28	11.15	12.14	13.02	14.00	14.88	15.86	16.74	17.72	18.60	19.58	20.46	21.44	22.32
9	5.91	6.89	7.88	8.86	9.85	10.83	11.82	12.80	13.78	14.77	15.75	16.74	17.72	18.71	19.69	20.68	21.66	22.65	23.63
9½	6.24	7.33	8.31	9.41	10.39	11.49	12.47	13.57	14.55	15.64	16.63	17.72	18.71	19.80	20.79	21.88	22.86	23.96	24.94
10	6.56	7.66	8.75	9.85	10.94	12.03	13.13	14.22	15.32	16.41	17.50	18.60	19.69	20.79	21.88	22.97	24.07	25.16	26.26
10½	6.89	8.10	9.19	10.39	11.49	12.69	13.78	14.99	16.08	17.29	18.38	19.58	20.68	21.88	22.97	24.18	25.27	26.47	27.57
11	7.22	8.42	9.63	10.83	12.03	13.24	14.44	15.64	16.85	18.05	19.25	20.46	21.66	22.86	24.07	25.27	26.47	27.68	28.88
11½	7.55	8.86	10.06	11.38	12.58	13.89	15.10	16.41	17.61	18.93	20.13	21.44	22.65	23.96	25.16	26.47	27.68	28.99	30.19
12	7.88	9.19	10.50	11.82	13.13	14.44	15.75	17.07	18.38	19.69	21.00	22.32	23.63	24.94	26.27	27.57	28.88	30.19	31.51
12½	8.21	9.63	10.94	12.36	13.68	15.10	16.41	17.83	19.15	20.57	21.88	23.30	24.62	26.04	27.35	28.77	30.09	31.51	32.82
13	8.53	9.96	11.38	12.80	14.22	15.64	17.07	18.48	19.80	21.33	22.76	24.18	25.60	27.02	28.44	29.87	31.29	32.71	34.13
13½	8.86	10.39	11.82	13.35	14.77	16.30	17.72	19.25	20.68	22.21	23.63	25.16	26.58	28.12	29.54	31.07	32.49	34.02	35.45
14	9.19	10.72	12.25	13.78	15.32	16.85	18.38	19.91	21.44	22.97	24.51	26.04	27.57	29.10	30.63	32.16	33.70	35.23	36.76
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
8	21.88	22.76	23.63	24.51	25.38	26.26	27.13	28.01	28.88	29.76	30.63	31.51	32.38	33.26	34.13	35.01	35.88	36.76	37.63
8½	23.30	24.18	25.16	26.04	27.02	27.90	28.88	29.76	30.74	31.62	32.60	33.48	34.46	35.34	36.32	37.20	38.17	39.06	40.04
9	24.62	25.60	26.58	27.57	28.55	29.54	30.52	31.51	32.49	33.48	34.46	35.45	36.43	37.41	38.40	39.38	40.37	41.35	42.34
9½	26.04	27.02	28.12	29.10	30.19	31.18	32.27	33.26	34.35	35.34	36.43	37.41	38.51	39.49	40.59	41.57	42.66	43.65	44.74
10	27.35	28.44	29.54	30.63	31.73	32.82	33.91	35.01	36.10	37.20	38.29	39.38	40.48	41.57	42.67	43.76	44.85	45.95	47.04
10½	28.77	29.87	31.07	32.16	33.37	34.46	35.66	36.76	37.96	39.06	40.26	41.35	42.56	43.65	44.85	45.95	47.15	48.25	49.45
11	30.09	31.29	32.49	33.70	34.90	36.10	37.31	38.51	39.71	40.92	42.12	43.32	44.53	45.73	46.93	48.14	49.34	50.54	51.75
11½	31.51	32.71	34.02	35.23	36.54	37.74	39.06	40.26	41.57	42.78	44.09	45.29	46.60	47.80	49.12	50.32	51.63	52.84	54.15
12	32.82	34.13	35.45	36.76	38.07	39.38	40.70	42.01	43.32	44.64	45.95	47.26	48.57	49.89	51.20	52.51	53.82	55.14	56.45
12½	34.24	35.56	36.98	38.29	39.71	41.03	42.45	43.76	45.18	46.50	47.92	49.23	50.65	51.97	53.39	54.70	56.12	57.44	58.86
13	35.56	36.98	38.40	39.82	41.24	42.67	44.09	45.51	46.93	48.35	49.78	51.20	52.62	54.04	55.47	56.89	58.31	59.73	61.15
13½	36.98	38.40	39.93	41.35	42.88	44.31	45.84	47.26	48.79	50.21	51.75	53.17	54.70	56.12	57.65	59.08	60.61	62.03	63.56
14	38.29	39.82	41.35	42.88	44.42	45.95	47.48	49.01	50.54	52.07	53.61	55.14	56.67	58.20	59.73	61.26	62.80	64.33	65.86

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SUGGESTED WORKING SHEET

Room No.	Room Name	Dimensions	Ceiling Height	Exposure	Floor Area	Cubic Contents	Lineal Feet Exposed Wall	Lineal Feet for Wall Above and Below Windows	No. and Size of Windows or Doors	RADIATION											
										For Wall	For Wall Above and Below Windows	For Total Wall	Correction for Other Wall Construction	For Windows	Net Radiation	Correction for Other Temp. Difference	Correction for Leaky Construction	Correction for Cold Floor, Ceiling or Adjoining Room	Add for Exposure	Total Radiation Required	Radiation Used
101	Office	12x14½	9	N.W.	174	1566	23½		2—32x30			23.63		14.44	38.07				11.42	49.49	
102	Office	12x13½	9	N.	162	1458	11½		1—44x30			11.82		9.63	21.45				7.51	28.96	

INSTRUCTIONS FOR CLEANING HEATING BOILERS

In the majority of cases, where a boiler primes or the water line fluctuates violently when steaming, this trouble is due to grease or a film of oil on the water surface and on the walls of water and steam space in boiler.

We would impress upon every heating contractor the tremendous importance of thoroughly cleaning out each installation and boiler before the job is left as finished. An ordinary blow down of the boiler is good. It should be done before the men have left the job, but the job should also be followed up a couple of weeks after it has been placed in operation, and the boiler then should be given a most thorough cleaning out.

Clear water boils without raising level

The following method is especially successful and is recommended by leading boiler manufacturers. Follow it carefully and thoroughly, and you will leave behind a satisfactory installation that will be a credit to you. A dirty boiler, no matter how well installed, will cause trouble sooner or later and become an expense.

Oil on surface of boiling water causes priming

METHOD OF BLOWING OFF A BOILER:

FIRST:—Close all radiator inlet valves throughout the job, and if a sensitive gauge is installed, shut the cock in the connection. Blow down the boiler through bottom blow-off or drain connection under a pressure not exceeding five pounds.

SECOND:—Prepare for a prolonged surface blow-off, and conduct it as follows: Remove the safety valve and connect a temporary blow-off pipe provided with a control valve to the safety valve tapping, extending it outside the building or to some suitable drain. Shut off all radiator valves or valves in main. Fill boiler with water to top of gauge glass. Build a very hot fire and blow steam and water out through the safety valve tapping and pipe; raise and keep pressure up to five pounds, fire hard; supply cold water constantly in at bottom of boiler, maintaining water line at top of gauge glass; keep up continuously and without interruption for six or eight hours; during the last two hours of the period fill boiler full of water, allowing the hot water to flow from it under the said pressure through and out of the top blow-off pipe. If boiler is provided with a surface blow-off tapping, use this in preference to safety valve tapping.

THIRD:—Close the water feed valve, bring the pressure up to five pounds, open blow-off at bottom of boiler; draw the fire quickly and entirely drain the boiler. Allow the boiler to cool, replace the safety valve, close blow-off, and fill the boiler slowly. One operation may be sufficient to thoroughly clean the system. Occasionally, however, it is necessary to repeat the operation several times. The condition of the boiler and system is generally indicated pretty well by the condition of the water in the gauge glass. If this appears dirty or greasy, it indicates that further cleaning out is necessary.

KEEP COMBUSTION CHAMBER AND FLUE SURFACES CLEAN

See table below, for capacity losses, for boilers, with soot covered surfaces.

Thickness of Soot	Loss Per Cent
Clean	0.0
1/32 inch	9.5
1/16 inch	26.2
1/8 inch	45.2
3/16 inch	69.0

COMFORT
CONDITIONING
by
DUNHAM

HOW TO FIRE A HEATING BOILER

The following recommendations upon **Methods of Firing** are time-proved in their ability to provide efficient boiler operation. The Application of these recommendations will necessarily vary with existing boiler conditions and grades of fuel. It is necessary to determine by experience the particular methods which are best for your boiler. Strict adherence to these methods, once established, will maintain most economical heating service.

WATCH THESE BOILER ESSENTIALS

1. You must have ample draft.
2. Be sure that your chimney and smoke pipe are tight, and are kept clean. Brush the flues of your boiler well, remove all soot — once a week is not too often. Keep the ash pit free from ashes.
3. Keep the boiler filled with water, see that all the doors of the boiler are tight and that all dampers are in working condition and properly adjusted.

COAL FIRING

Use coal of uniform size. If anthracite or hard coal is used, the stove or egg size is preferable; if bituminous or soft coal is used the small lump or the nut size is the more desirable.

FIRING BITUMINOUS COAL. The best results will be obtainable by observing the following recommendations:

Start the fire in the usual manner and when you have a good bed of live coals start the coking method of firing which will keep a steady even heat at all times. The coking method is as follows: Push the live or partly burned coal, from which the gas has been driven, to the rear of the fire pot, and then throw the fresh coal in at the front. Fire large charges. Keep the fuel bed level all over and as thick as the size of coal and draft will permit. If there are lumps in the coal as fired, fill the spaces in between the lumps with fine coal. In no case should you cover the live coals all over, but always leave a certain amount of the live coals exposed, because the covering of the whole fuel bed causes too much smoke and wastes fuel. Fire at regular times each day.

FIRING ANTHRACITE. Observe the following recommendations:

Keep the fuel bed thick. Do not stir the fire or poke it from above. Have a bright bed of coal over the entire grate before firing more fuel. Fire heavy charges at regular intervals. Before firing push some of the burning coal to the rear of the grate nearest the opening where the gases leave the fire pot, making the bed of live coal thicker there. Then fire the fresh charge so as to make the bed approximately the same thickness all over, and yet leave visible a bright spot of live coal to ignite the combustible gases coming off the freshly-fired fuel. If fire is low fire lightly and allow each firing to become ignited before fresh coal is thrown on. When a sufficient bed of live coals is formed, fire as directed in the first part of this paragraph.

When the boiler and fire pot is small the foregoing methods are modified to the extent that the live fire should be pulled toward the fire door, and fresh coal fire being placed at the rear.

IN BANKING THE FIRE FOR THE NIGHT

Proceed as for firing, only put in more fuel and do not shake the fire. Close the draft damper and open the check damper. In the morning open the draft damper and close the check damper. Shake the fire, clean out the clinkers and push the live coals to the rear of the grate. Throw in fresh fuel at the front. Leave a large amount of the live coals exposed.

IF COKE IS USED

Carry a thicker fuel bed than for coal. Also set the drafts for a lesser opening. Always allow the coke to ignite well before closing the drafts after firing. Use the same method of firing as given above. Do not poke the fire from above.

IN MILD WEATHER

Allow ashes to accumulate on the grate. Do not shake the fire too much. Shake only until light from the fuel bed shows in the ash pit. Keep the ash pit free from ashes. Keep the fire cleaned of all clinkers.

DUNHAM RETURN HEATING SYSTEM

USING RETURN TRAP OR CONDENSATION PUMP

THE Dunham Return Heating System is a two-pipe steam system operating at pressures up to 15 pounds and utilizing a Dunham Return Trap or Dunham Condensation Pump to provide positive return of condensate to boilers.

This system is adaptable for apartment buildings, small hotels and medium sized commercial or industrial buildings, and schools and churches. It does not afford the temperature regulation, comfort and fuel saving advantages of Differential Heating, but the provision for retaining self-induced vacuums under conditions of a declining fire prolong the periods in which heat is supplied and thus tend to minimize the defects of "on" and "off" heating.

Boilers

The boiler or boilers should be liberal in size for the radiation, full allowance being made for the different condensing rates of the different classes of radiation used. The chimney should be liberal in size with good draft. The immediate piping connections from and to the boiler must be the full size of boiler tappings and the steam header bled by a large equalizing pipe to the return header to provide for complete boiler equalization.

Dripping Steam Mains

The ends of the steam mains may be dripped and freed from air in two distinct ways:

The first method is illustrated in Fig. 844B This method is recommended whenever applicable because it permits the return piping to be installed higher up, giving a greater head to the Return Trap. The air is vented into the return main and the water is returned direct to the boiler through the drip piping. This method is not used when a reducing valve is placed in the steam mains. No two drips should be connected above the boiler water line.

The second method requires the installation of a Dunham Float and Thermostatic Trap of proper capacity at the end of each steam main to drip it directly into the return main as shown in Fig. 925B. The condensate as well as the air in this case passes into the return main and the water is returned to the boiler by the Return Trap or Condensation Pump. This method must always be used when a reducing valve is used.

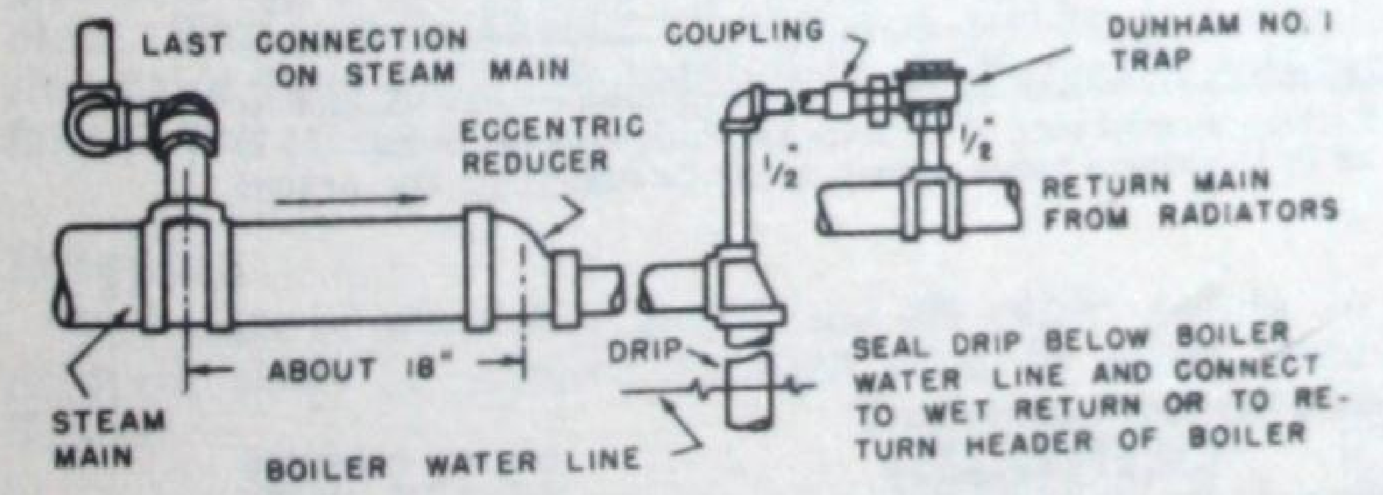

LAST CONNECTION ON STEAM MAIN
ECCENTRIC REDUCER
COUPLING
DUNHAM NO. 1 TRAP
½"
½"
RETURN MAIN FROM RADIATORS
ABOUT 18"
DRIP
SEAL DRIP BELOW BOILER WATER LINE AND CONNECT TO WET RETURN OR TO RETURN HEADER OF BOILER
STEAM MAIN
BOILER WATER LINE

Fig. 844B
Method of dripping and venting end of steam main

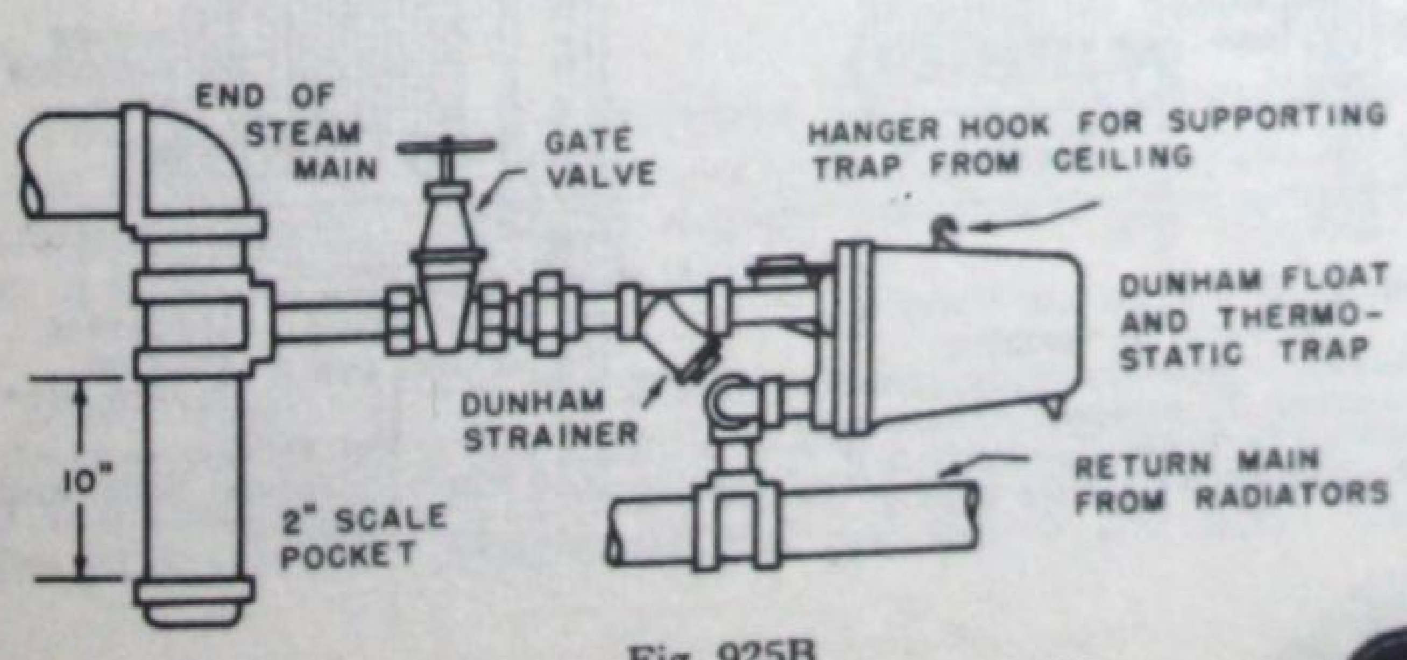

END OF STEAM MAIN
GATE VALVE
HANGER HOOK FOR SUPPORTING TRAP FROM CEILING
DUNHAM FLOAT AND THERMOSTATIC TRAP
DUNHAM STRAINER
10"
2" SCALE POCKET
RETURN MAIN FROM RADIATORS

Fig. 925B
Method of dripping end of steam main

Grading

Grade steam mains with a fall of ½ inch in 10 feet, and return mains 1 inch in 10 feet in direction of flow. Grade all runouts and springpieces not less than ½ inch per foot. When conditions permit, run steam and return mains together and grade in same direction, using the "reverse return" method of layout

The boiler should be so located that the bottom of the return main at its lowest point will be a sufficient distance above the main boiler water line to permit installation of Return Trap with its bottom at least 6 inches above the boiler water line. The No. 8 Return Trap requires a 20 inch height for this purpose, the No. 9 Trap 24 inches and the No. 10, 11 and 12 Traps 26 inches.

Where the return piping cannot be installed in accordance with the above requirements, or the boiler cannot be lowered to provide for this minimum height of the dry return, the use of a Dunham Condensation Pump and Receiver becomes necessary.

Equalizer Connection

The steam and return lines are cross connected as shown in Fig. 1204B. This connection insures that the steam main pressure will not fall below the return main pressure as might otherwise occur when a declining fire resulted in an induced vacuum in the supply piping and radiation which would inhibit circulation and hold water in the radiator.

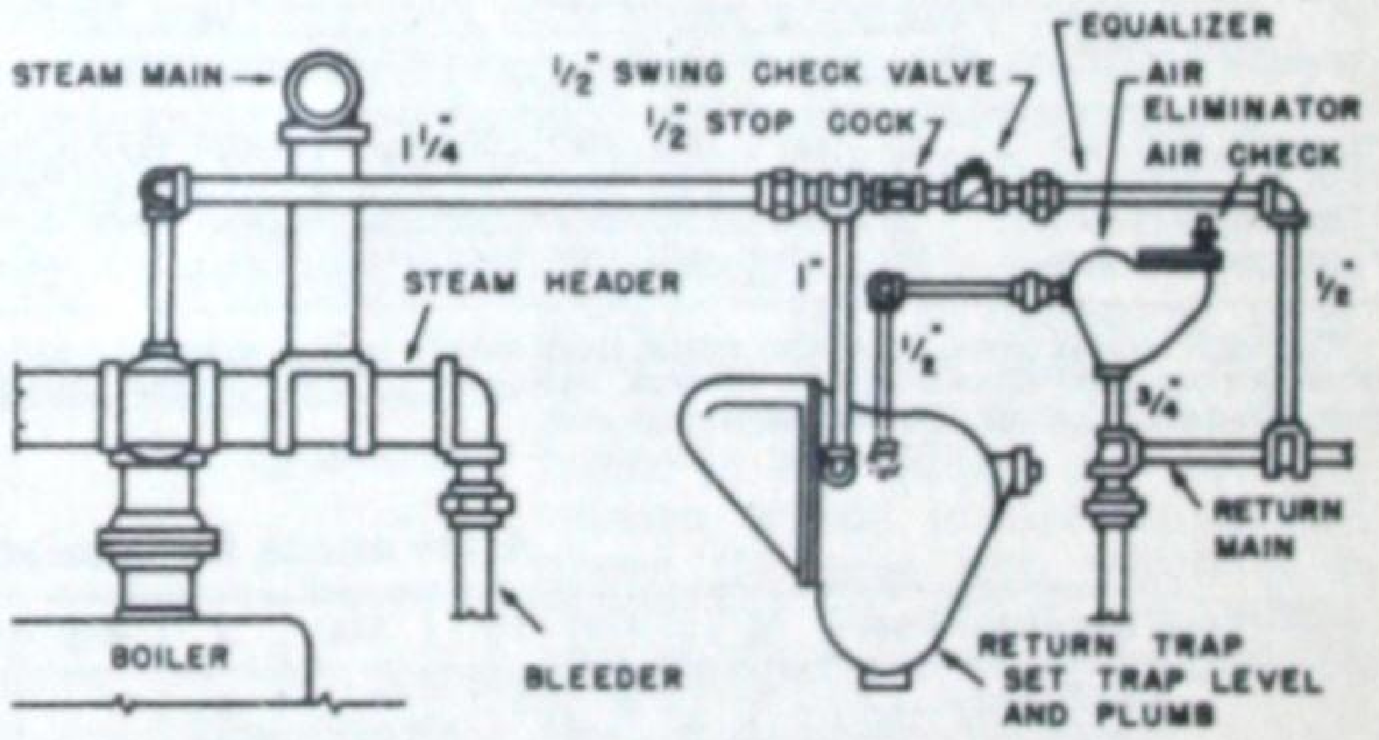


Fig. 1204B
Typical arrangement of equalizer connection between steam and return sides of a Dunham Return Heating System.

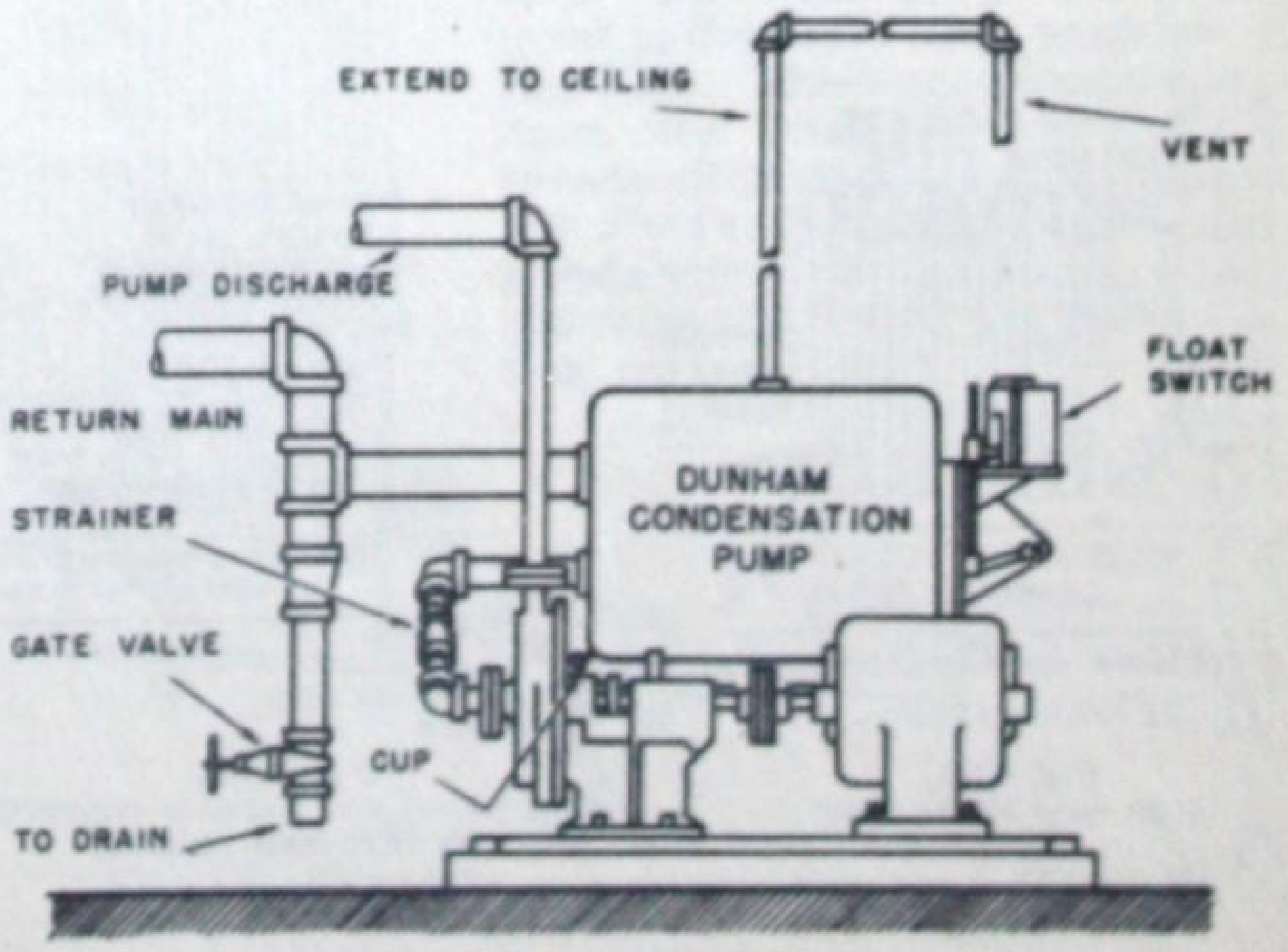


Fig. 3009
Type CH Condensation Pump and Receiver

RETURN STEAM SYSTEM PIPE SIZES

BASED ON INITIAL PRESSURES OF 1 TO 2 POUNDS GAUGE FOR INSTALLATIONS USING RETURN TRAP OR CONDENSATION PUMP

Pipe Sizing

The pipe sizes for this system are based upon an initial operating pressure of 1 to 2 pounds gauge, although pressures up to 15 pounds may be used if desired. No smaller piping should be used than shown in the following tables, and care should be taken to ascertain the length of all runs with allowances added, in determining sizes.

Steam Mains

Pipe Sizes Inches	Capacities in Square Feet of Direct Cast Iron Radiation for Each Length							
	*LENGTH IN FEET							
	100	200	300	400	500	600	800	1000
2	670	570	470	410	360	330	290	250
2½	1,090	930	760	670	590	530	470	410
3	1,930	1,650	1,340	1,170	1,030	940	820	730
3½	2,810	2,400	1,950	1,710	1,510	1,370	1,200	1,060
4	3,900	3,340	2,720	2,380	2,100	1,900	1,670	1,480
5	7,000	5,950	4,850	4,260	3,740	3,400	2,980	2,640
6	11,200	9,550	7,780	6,830	6,000	5,460	4,780	4,240
8	23,400	20,000	16,250	14,250	12,540	11,400	10,000	8,840
10	40,800	34,800	28,400	24,800	21,900	19,900	17,400	15,400

*Length equals distance along piping from source of steam supply to top of farthest riser or radiator on main plus allowances for elbows, valves and plus 25 feet allowance for radiator connection.

Steam Main Drips

Pipe Sizes	1¼	1½	2	2½	3	3½	4	5
Capacity in Sq. Ft....	1,400	2,700	5,500	9,000	16,000	23,000	32,000	57,000

Riser Sizes

Pipe Sizes	Steam							Return	
	¾	1	1¼	1½	2	2½	3	¾	1
*Length, 200 feet....	45	90	190	290	570	930	1,650	600	1,200
*Length, 400 feet....	30	60	136	200	410	670	1,170	430	850
*Length, 600 feet....	25	50	110	165	330	530	940	340	670
*Length 1000 feet....	20	40	85	130	250	410	730	260	530

*Length equals distance along piping from source of steam supply to top of each riser plus allowances for elbows, valves and plus 25 feet allowance for radiator connection.

Return Mains

Pipe Sizes Inches	Capacity in Square Feet of Direct Cast Iron Radiation								
	1	1¼	1½	2	2½	3	3½	4	5
Mains under 400 ft. long	400	1,400	2,700	5,500	9,000	16,000	23,000	32,000	57,000
Mains over 400 ft. long	300	1,000	1,700	3,400	5,500	10,000	14,000	20,000	35,000

Radiator Connections

Square Feet of Direct Radiation	SUPPLY			RETURN		
	Size Inlet Valve Inches	Vertical Pipe to Inlet Valve Inches "A"*	Horizontal Runout to Riser or Spring-piece to Main from a First Floor Radiator, Inches "B"	Trap No.	Stub to Trap and Size of Trap Inches	Horizontal Runout to Riser or First Floor Radiator Inches "C"
1– 25	½	½	¾	1	½	¾
26– 80	¾	¾	1	1	½	¾
81–100	¾	¾	1¼	1	½	¾
101–140	¾	¾	1¼	1	½	¾
141–170	¾	¾	1½	1	½	¾

*"A," "B" and "C" refer to typical connections shown in Figs. 813B, 808C, 809C and 810B.

If horizontal connections, springpieces and runouts are over 8 feet long, use pipes one size larger than given above.

Grade horizontal connections, both steam and return, with a fall of not less than ½ inch per foot.

Allowances for Resistance to Flow in Feet of Pipe

Pipe Size—Ins.	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16
For Elbows.....	2	2	2	3	5	6	9	10	14	19	24	35	47	59	70	82
For Globe Valves	2	3	3	5	7	9	14	15	21	28	36	53	70	88	106	124

In sizing pipes, the length of the pipe must be ascertained, and the frictional resistance of fittings and valves considered. It is customary to reduce the resistance to equivalent length of straight pipe, as in the above table, which must be added to the actual length.

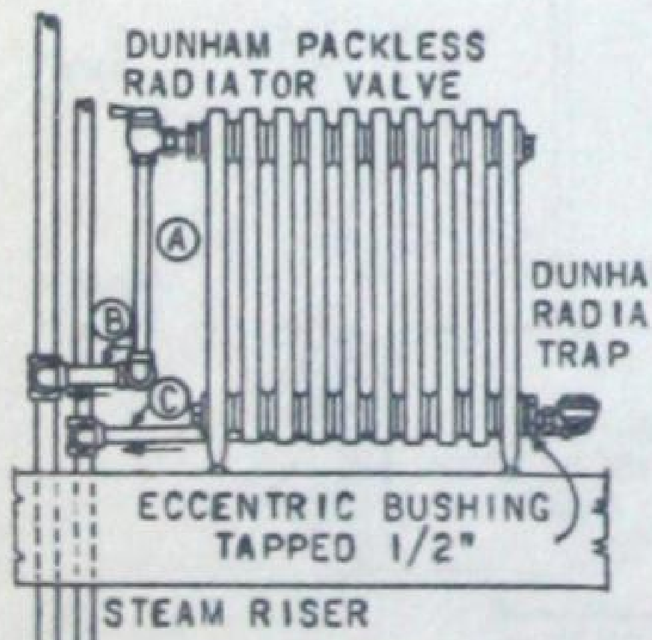


Fig. 808C
Run outs above floor

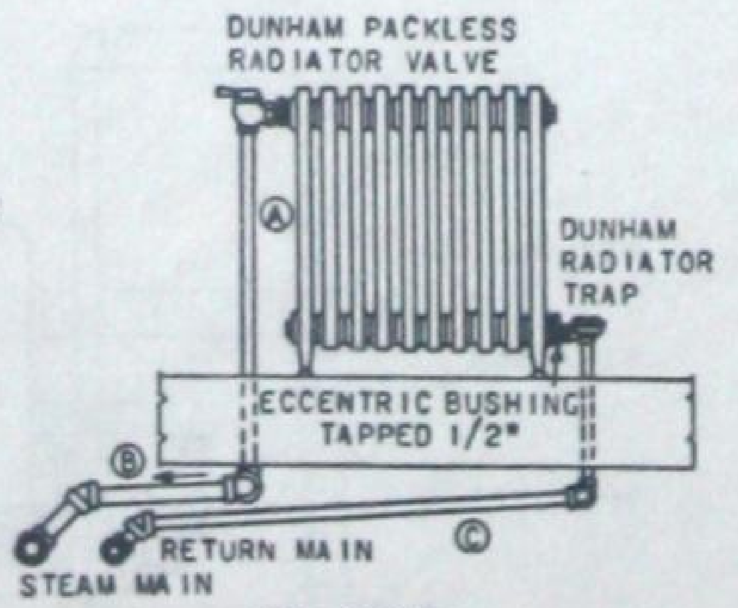


Fig. 813B
Spring pieces and radiator connections for first floor radiator

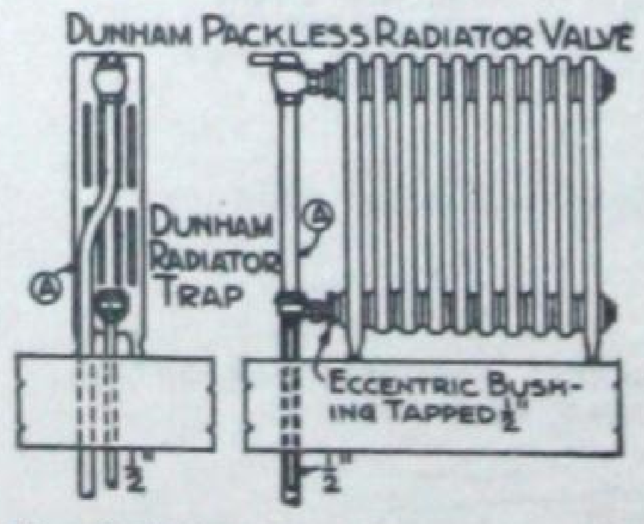


Fig. 810B. Trap and Valve at same end of radiator Column radiators only, not to exceed 15 sections. Recommended for upper floors in small buildings to simplify piping

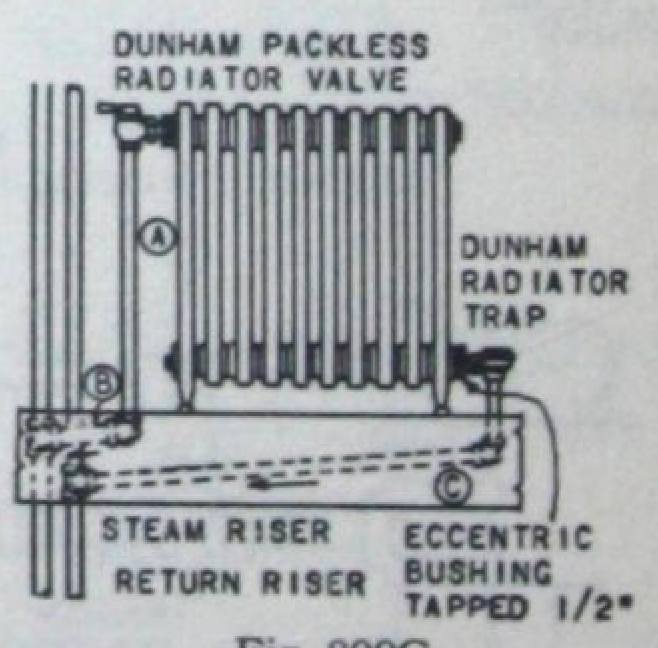


Fig. 809C
Run outs between floor and ceiling

THE DUNHAM VACUUM RETURN LINE HEATING SYSTEM

GENERAL DESIGN - TYPICAL INSTALLATION

THIS is a two-pipe steam heating system employing atmospheric pressure or higher in the steam supply piping and radiation and a partial vacuum in the return piping to ensure positive circulation.

This system provides positive, rapid, noiseless steam circulation. It is simple in essential design and equipment, reliable in operation and is applicable to all types of buildings. It provides control of the heat output only within a narrow range of steam pressures and temperatures which is insufficient for adequate temperature regulation. It is recommended for installations in which temperature regulation is not a primary consideration.

System Design

The general arrangement of all the component parts of a typical system equipped with a low pressure boiler is illustrated in Fig. 889B,

Where a high pressure boiler is used and where central station steam is supplied at greater than heating pressure, a pressure reducing valve is used in the steam main to reduce the steam pressure.

It is good design to provide a by-pass in return main where Returns are located above the boiler water line so that condensate can return to Boiler by gravity in case of failure of electric current.

Grading

All piping, both steam supply and return, must be graded in the direction of flow with the exception of the steam supply springpieces to up feed risers and the runouts to radiators which must have an especially good grade of not less than ½ inch per foot back to the main and riser respectively, and be made of at least one size larger pipe. Steam and return mains must be graded with a fall of not less than ½ inch in 10 feet.

Emphasis is placed upon the importance of careful piping design and installation, elimination of the possibility of sags and pockets, and careful grading of all springpieces and runouts. The system should be designed and installed so that the entire piping will completely free itself of water by gravity flow to the receiver of the pump.

Dripping

The ends of all steam mains and all other points to be dripped, shall be dripped through properly sized Dunham Traps

Each drip point shall be provided with a scale pocket and a gate valve on the steam side of the trap.

Pump

The pump used is the Standard Dunham Vacuum Return Line Heating Pump Heating system design may call for a single automatic pump, a duplex automatic arrangement, or a continuous operation unit.

The Single Automatic Pump Installation is applicable whether the returns come back to the pump at ceiling height, at the pump level, or below the level of the floor on which the pump rests. Where returns are below the floor, the Accumulator Tank may be placed at a level which permits the condensate to flow to it by gravity. The return of condensate is not affected by the varying pressure conditions which may exist in the system. The pump is arranged for either vacuum or float control. This assures protection for the boiler and economy of electric consumption during night operation.

The Duplex Automatic Pump Installation, used on larger systems, offers the same flexibility in control and the added feature of maximum economy. The pump capacity and consequently the power consumption can be kept more closely in accord with the heating demand. Either unit may be operated independently. This minimizes the possibility of a shut down under emergencies.

The Continuous Operation Installation is logical where the greater part of the load is blast radiation or where there are lifts distant from pump. Such lifts makes it advisable to maintain a high vacuum at all times.

Lift Connections

While it is possible to locate radiators below the level of the return piping by using lift connections, the practice is not always advisable. The suggestion is made that lift fittings be used sparingly and only when absolutely necessary. A vacuum return line system without lifts can circulate steam under emergency conditions with the vacuum pump inoperative. Where lifts are present, the pump must be continually in operation or circulation ceases. Lifts must always be provided with a lift pocket and a draw-off at low point. Lifts at radiators must have a Dunham Trap at high point, or above the lift as illustrated in Fig. 958A. The lift connection should always be carried above the pipe into which it is discharged as shown. Dunham Lift Fittings are made in sizes ¾ inch to 2 inches inclusive

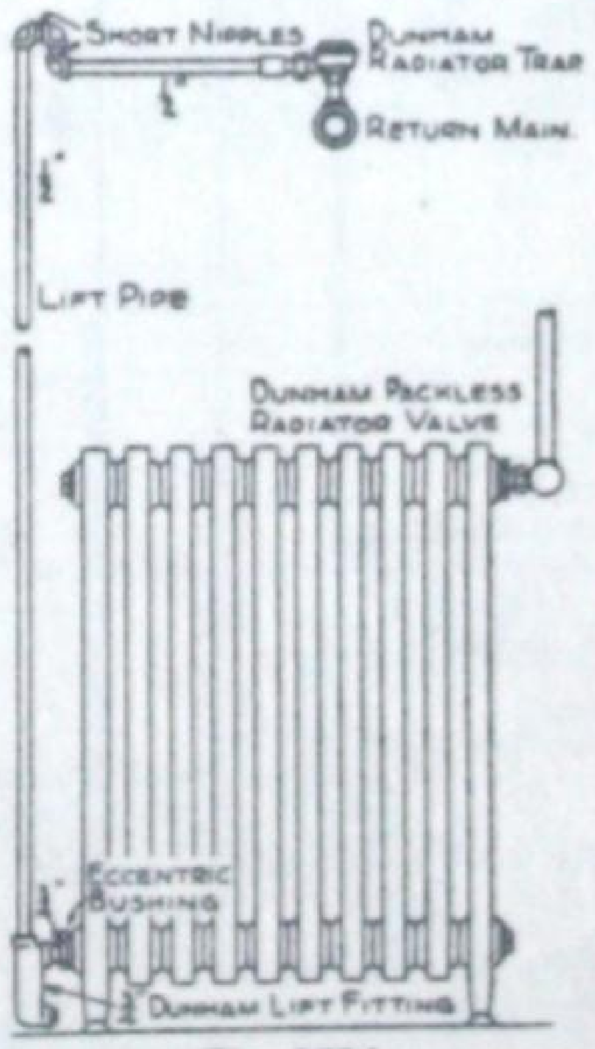
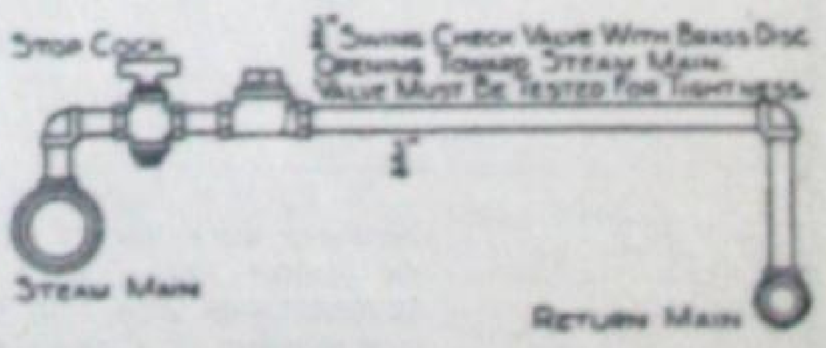


Fig. 958A
Lift fitting and trap location when radiator is below return main of vacuum return line system.

Equalizer Connection

The steam and return mains are cross connected at a convenient point in the boiler room as shown in Fig. 1153. This arrangement eliminates the tendency to establish reverse circulation through the system when an induced partial vacuum is established in the steam piping and radiation during low fire operation


Stop Cock
½" Swing Check Valve With Brass Disc Opening Toward Steam Main. Valve Must Be Tested For Tightness.
½"
Steam Main
Return Main

→ Fig. 1153—Equalizer

Can. File No. 15J-I-1
Date: April 1, 1942

Replaces File No.
Dated:

THE DUNHAM VACUUM RETURN LINE HEATING SYSTEM

TYPICAL INSTALLATION PRACTICE

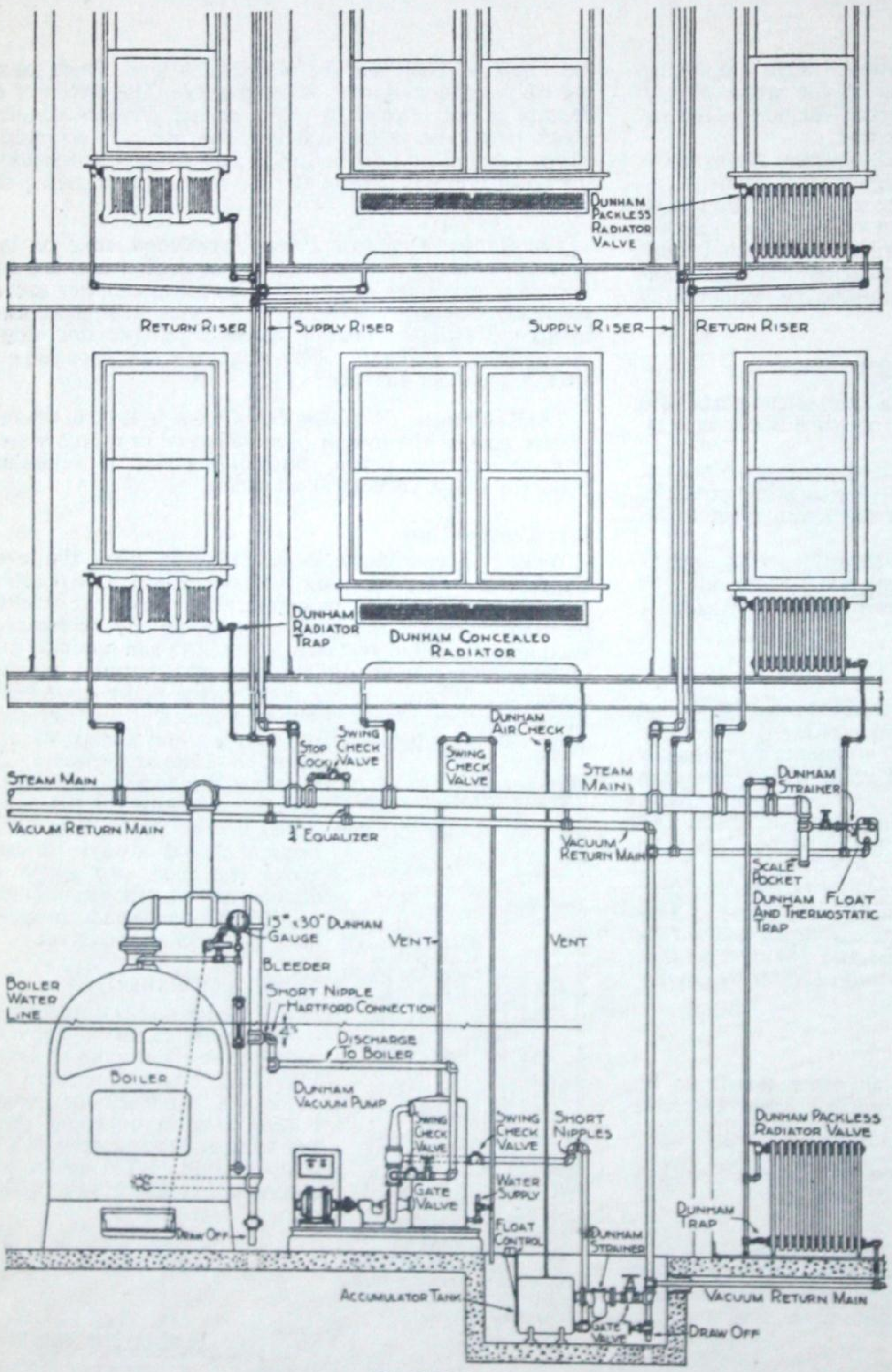


Fig. 889B (part)

A typical installation of a Dunham Vacuum Return Line Heating System with steam supply from a low pressure boiler. The arrangement of steam and return mains, risers, runouts, springpieces and radiator connections and the sizing, grading, supporting and anchoring of piping are similar to those used for a Differential Heating System.

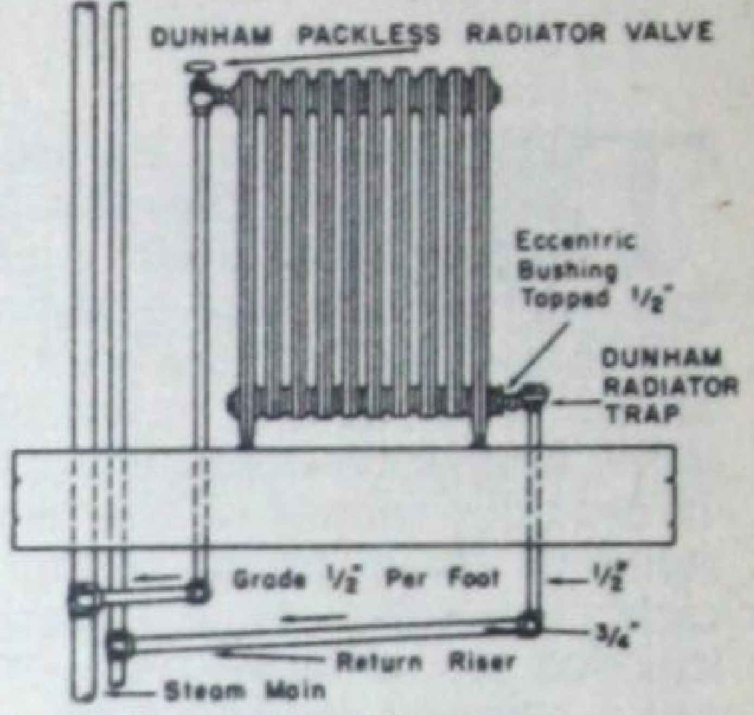


Fig. 2071

Connections where runouts are below the ceiling. Similar connections are used if runouts are between floor and ceiling.

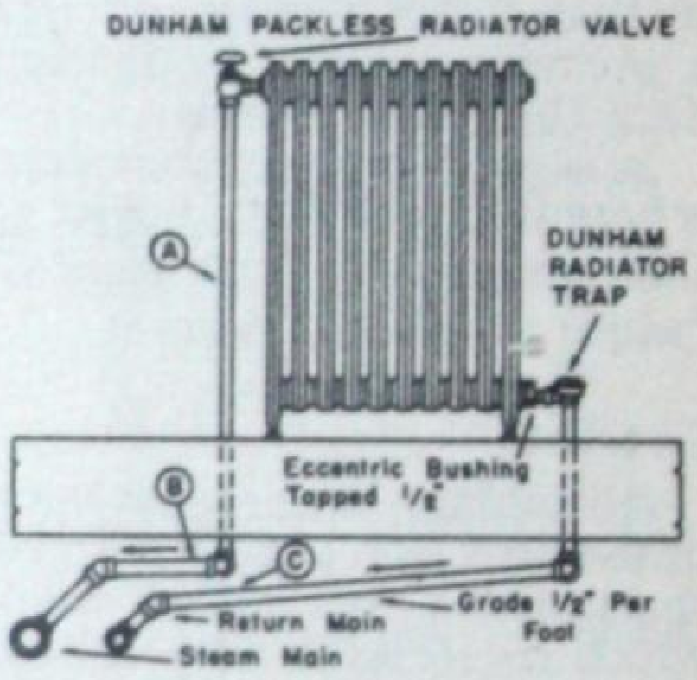


Fig. 2072

Spring pieces and connections for a first floor radiator.

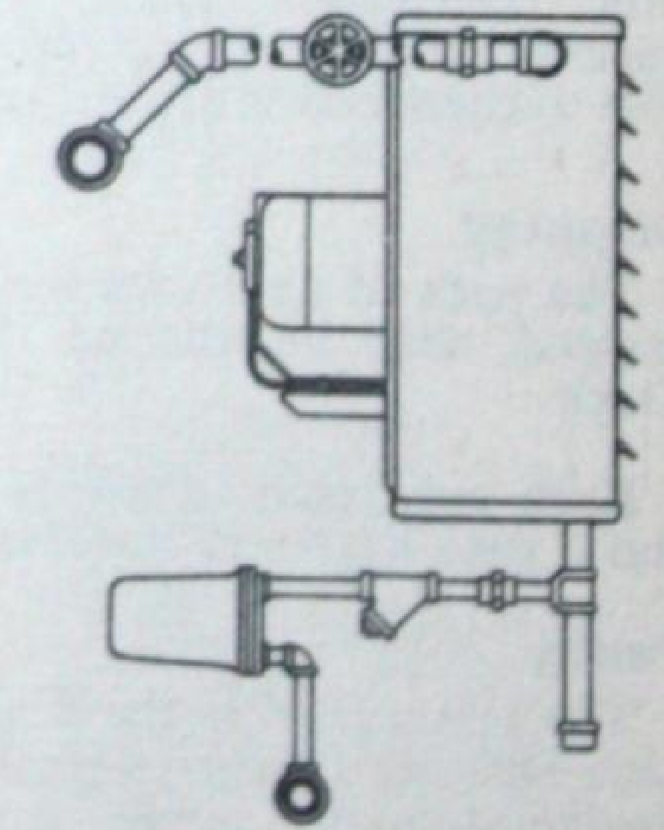


Fig. 2068

Piping connections recommended for sub-atmospheric steam, vacuum return line, or vapor system applications.

PIPE SIZES - VACUUM RETURN LINE SYSTEM

Installation in accordance with the following tables assures ample pipe area for the flow of steam, air and condensate.

Steam Mains

Pipe Sizes Inches	CAPACITIES IN SQUARE FEET OF DIRECT CAST IRON RADIATION FOR EACH LENGTH OF RUN										
	†LENGTH OF RUNS IN FEET										
	100	**200**	**300**	**400**	**500**	**600**	**800**	**1,000**	**1,500**	**2,000**	**3,000**
2	1,130	800	650	570	500	450	400	350	300	250	200
2½	2,100	1,470	1,200	1,050	925	840	735	650	550	460	380
3	3,800	2,660	2,160	1,900	1,670	1,520	1,330	1,180	990	830	680
3½	5,500	3,850	3,140	2,750	2,420	2,200	1,920	1,700	1,430	1,210	990
4	7,750	5,400	4,400	3,900	3,400	3,100	2,700	2,400	2,000	1,700	1,400
5	13,800	9,650	7,800	6,900	6,100	5,500	4,800	4,300	3,600	3,040	2,480
6	22,200	15,500	12,600	11,000	9,800	8,900	7,800	6,900	5,700	4,900	4,000
8	46,000	32,000	26,200	23,000	20,200	18,400	16,100	14,200	12,000	10,100	8,300
10	80,700	56,500	46,000	40,300	35,500	32,200	28,200	25,000	21,000	17,700	14,500
12	127,000	89,000	72,500	63,500	56,000	51,000	44,500	39,400	33,000	28,000	23,000
14	164,000	115,000	93,500	82,000	72,000	65,600	57,400	51,000	42,600	36,100	29,500
16	234,000	164,000	133,400	117,000	103,000	93,600	82,000	72,600	61,000	51,500	42,100

†The *length* is the distance along piping from the *boiler or reducing valve to the farthest radiator plus allowances for elbows and valves (see table "Allowances for Resistance to Flow") and plus 25 feet allowance for last radiator connection. Do not reduce any steam main below 2½ inches in size at its end, which starts larger and is dripped at end.

Return Mains

Pipe Sizes, Inches		1	1¼	1½	2	2½	3	3½	4	5	6
Capacity in Square Feet per Length of Run in Feet	**400 ft.**	800	1,600	4,000	11,000	21,000	38,000	55,000	78,000	138,000	220,000
	1,000 ft.	500	1,000	2,500	7,000	13,000	23,500	34,000	48,000	86,000	138,000
	2,000 ft.	350	800	1,800	5,000	9,000	16,000	24,000	34,000	60,000	98,000
	3,000 ft.	300	600	1,500	4,000	7,500	13,500	20,000	28,000	50,000	80,000

The *length* is the distance along piping from the Pump to the farthest radiator plus allowances for elbows and valves (see table "Allowances for Resistance to Flow").

Vertical Risers

Pipe Sizes, Inches		STEAM RISERS									RETURN RISERS		
		¾	1	1¼	1½	2	2½	3	3½	4	¾	1	1¼
Capacity in Square Feet per Length of Run in Feet	**200 ft.**	66	133	290	450	920	1,510	2,660	3,850	5,400	1,000	2,000	4,500
	400 ft.	47	95	210	325	655	1,080	1,900	2,750	3,900	800	1,600	3,400
	600 ft.	38	76	166	260	525	865	1,520	2,200	3,100	640	1,200	2,500
	1,000 ft.	29	59	129	200	410	670	1,180	1,700	2,400	500	1,000	2,100
	2,000 ft.	20	42	92	143	290	475	830	1,210	1,700	350	700	1,500

Determine the *length* of run for each riser exactly the same as for Steam Mains, that is from the *boiler or reducing valve to the farthest radiator supplied by the riser.

Springpieces are the connections from steam mains to risers. Springpieces to upfeed risers are taken off the top of steam mains at 45 degrees and must be at least one pipe size larger than bottom of the riser.

Springpieces to downfeed risers may be taken off the bottom of the steam main at 90 degrees and should be same size as top of the riser, grading downward with the direction of steam flow so that the main will be drained of condensate. If springpieces to downfeed risers are taken off the top of steam main at 45 degrees, then the main must be provided with drips and traps to drain it.

Springpieces to upfeed risers or horizontal offsets in risers, when over 8 feet long, should be made two pipe sizes larger than the riser to which they connect. Springpieces from return risers to return mains should be same size as bottom of the return risers.

Radiator Connections

Square Feet of Direct Radiation	SUPPLY			RETURN		
	Size Inlet Valve Inches	Vertical Pipe to Inlet Valve	Horizontal Runout to Riser or the Springpiece to Main from a First Floor Radiator	Trap No.	Stub to Trap and Size of Trap Inches	Horizontal Runout to Riser or First Floor Radiator Inches
1- 25	½	½	¾	1 A	½	¾
26- 80	¾	¾	1	1 A	½	¾
81-100	¾	¾	1¼	1 A	½	¾
101-140	1	1	1¼	1 A	½	¾
141-180	1	1	1½	1 A	½	¾
181-200	1¼	1¼	1½	1 A	½	¾
201-300	1¼	1½	1½	2 B	½	¾
301-400	1½	1½	2	2 B	½	¾
401-450	1½	1½	2	3 A	¾	¾
451-700	2	2	2½	3 A	¾	¾

If horizontal connections, springpieces and runouts are over 8 feet long, use pipes one size larger than given above. Grade horizontal connections, both steam and return, with a fall of not less than ½ inch per foot.

Allowances for Resistance to Flow in Feet of Pipe

Pipe Size—Ins.	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16
For Elbows.....	2	2	2	3	5	6	9	10	14	19	24	35	47	59	70	82
For Globe Valves	2	3	3	5	7	9	14	15	21	28	36	53	70	88	106	124

In sizing pipes, the length of the pipe must be ascertained, and the frictional resistance of fittings and valves considered. It is customary to reduce the resistance to equivalent length of straight pipe, as in the above table, which must be added to the actual length.

THE DUNHAM
VACUUM RETURN LINE HEATING SYSTEM
A TYPICAL SPECIFICATION

1. THE GENERAL CONDITIONS governing this work shall be those established as standard for the construction of buildings by the Institute of Architects.

2. CONSTRUCTION AND MATERIALS. The heating installation proposed includes the furnishing, delivery and erection of all necessary material, which shall be first class in all particulars and in accordance with the specifications, heating plans and manufacturer's details.

3. INSPECTION. The contractor shall allow the C. A. Dunham Company's representative to inspect the installation and shall lend any assistance necessary to expedite and perfect the work.

4. BOILER. The steam boiler (s) (low pressure) shall be (type of boiler desired) with guaranteed rating for at least ____ sq. ft. of equivalent direct radiation. It shall be installed in accordance with boiler manufacturer's instructions. It shall be equipped with all necessary connections and trimmings, including a safety valve set for 10 lbs. pressure, a Dunham Compound Gauge 15 lbs. by 30" vacuum, and a sensitive Damper Regulator. *(Omit Regulator on gas-fired and automatic oil-fired installations.)*

5. AUTOMATIC BOILER FEEDER. Furnish and install on each manually operated coal, oil, gas-fired or stoker or blower equipped boiler a self-cleaning automatic water feeder, complete with all fittings recommended by manufacturer.

6. AUTOMATIC BOILER CONTROL. Furnish and install an automatic equipment for low water cut-off of fuel supply on all automatic gas, oil or stoker-fired boilers complete with all electric wiring and piping required according to manufacturer's instructions.

7. SMOKE PIPE. Connect boiler to chimney with suitable black iron smoke pipe. Size and gauge to be as recommended by Boiler Manufacturer. Smoke pipe must be provided with hand stop damper. *(Omit hand stop damper on gas-fired and oil-fired installations.)*

8. PIPE AND FITTINGS. Furnish and erect a system of steam supply and return piping. All piping to have tight connections, be properly supported, anchored and graded to insure free and noiseless circulation. Use wrought steel pipe (or wrought iron pipe), and cast iron fittings of standard weight and quality. The ends of all pipes shall be reamed or filed. Use graphite and oil applied to male thread only for making up all pipe joints. Provide for expansion of mains and risers by using loop type expansion joints and swing connections wherever required and possible. In other cases provide approved all-metal packless expansion joints.

9. All steam tappings in boiler (low pressure) shall be connected full size of tapping into a steam header which shall be dripped to the return header through a bleeder. Springpieces to steam and return mains on up-feed systems shall be taken off top of mains at 45 degrees. On down-feed systems take springpieces from bottom of overhead steam main at 90 degrees.

10. The end of each steam main, down-feed riser and drip point shall be drained into return main using a gate valve, Dunham Strainer and Dunham Trap as indicated on plans. Each drip shall flow by gravity into the return main. No lift connection shall be used.

11. Grade steam mains, returns mains and drip piping ½ inch in 10 ft. All steam supply springpieces, offsets in steam risers and runouts to radiators which grade in a direction opposite to steam flow shall be installed not less than one size larger than the vertical pipe to which they connect and graded ½ inch per foot. Grade return springpieces ½ inch per foot.

12. Return mains shall be connected to the Accumulator Tank of Dunham Vacuum Return Line Heating Pump as shown in detail furnished by manufacturer. Lift connections must not be used except between pump and accumulator tank. There must be gravity flow of water and air from all drip and radiator traps and drip points into the accumulator tank.

13. Risers are to be run concealed or in the open as directed by the architect. All concealed piping must be tested and made tight at 15 lbs. water pressure before being concealed and covered.

14. All union connections, flanges, packing nuts on gate and globe valves and on gauge glass of boiler must be drawn up tight so as to prevent air leaking into system when under a partial vacuum. This work must be performed after system is completed and while it is under a vacuum.

15. FLOOR PLATES, SLEEVES. Furnish approved floor and ceiling plates and sleeves on all pipes passing through floors or partitions.

16. VALVES AND CHECK VALVES. All shut-off valves in steam and return piping (excepting radiator inlet valves) shall be gate valves of approved make. Valves 2 inches and under shall be brass; 2½ inches and larger to be iron bodies, brass trimmed; 5 inches and larger shall be flanged. Check valves shall be horizontal or angle swing type of approved make with light weight brass disc, tested for tightness. Check valves shall be installed where shown on plans or details, and wherever necessary.

17. RADIATION. Furnish and install radiation as shown on the plans. There shall be a total of ____ sq. ft. of (cast iron tube type or concealed type) radiation of approved make. All cast iron direct radiation to have top inlet tapping and eccentric return outlet at bottom.

18. RADIATOR TRAPS AND VALVES. Each radiator shall be provided at its return outlet with a Dunham Radiator Trap of suitable size for satisfactory operation. The outlet of these traps to be connected to the return piping. A Dunham Packless Radiator Valve of proper size shall be installed at inlet connection of each exposed radiator.

19. DUNHAM VACUUM RETURN LINE HEATING PUMP. Furnish and install one (or Duplex) Dunham Vacuum Return Line Heating Pump of size ____, having a rating of ____ sq. ft. of equivalent direct radiation. The pump (or pumps) shall be installed, connected and wired in accordance with manufacturer's instructions.

20. PAINTING. All Exposed Piping, and parts of Boiler and radiators shall be painted as directed by the architect. The paint must be applied when the entire system is under vacuum.

21. COVERING. Cover all steam mains and their springpieces with four-ply, 1-inch thick asbestos sectional covering secured in place with metal bands. Fittings to be covered with asbestos cement. All steam and return piping run concealed in outside walls or concealed in partition within 18 inches of outside wall shall be covered with two-ply ½-inch thick asbestos sectional covering. Cover boiler as specified by boiler manufacturer.

22. FINISHING UP. Thoroughly blow down and clean out system under a steam pressure of 5 lbs., allowing condensate to be wasted to sewer. Operate system a week with Temporary Caps or Elbows installed on radiator traps. After this period then surface blow-off the boiler, as follows:

Remove safety valve and connect a temporary blow-off pipe to safety valve tapping, extending it outside or to some suitable drain. Shut off all radiator valves or valves in main. Fill boiler with water to top of gauge glass. Build a very hot fire and blow steam and water out through the safety valve tapping and pipe connected thereto. Fire hard with not more than 5 lb. pressure on boiler. Supply cold water constantly at bottom of the boiler. Continue this for two hours. At end of period, close water feed valve, draw the fire quickly, open blow-off at bottom of boiler and entirely drain boiler, replace safety valve. Fill boiler slowly after it becomes cold. Remove the Dunham Temporary Caps or Elbows and install in their place the Dunham Traps.

23. TEST. The system shall be tested for tightness by filling with water to its top. Pockets of air in the piping or radiators must be vented to allow water to enter. All leaks must be made tight.

24. GUARANTEE. The Contractor shall guarantee the apparatus installed to circulate steam thoroughly through every radiator without noise, under a steam pressure on the heating mains not to exceed two pounds. If the apparatus shall fail to accomplish this guarantee by reason of any defect developing within the first heating season and that defect is due to faulty material or poor workmanship, the Contractor shall remedy such defect at his expense within reasonable time after notice.

25. FINALLY. Nothing herein contained shall be construed to relieve the Contractor from making good and perfect work in all details.

A Summer Check-up of Steam Heating Systems for Economical Winter Service

This discussion of the maintenance of steam heating plants during the "shut-down" months is presented in the belief that it will be of service to those charged with the responsibilities of efficient, economical operation and maintenance of buildings.

There is an old adage "what the eye does not see, the heart does not grieve over." This adage often applies to the summer attitude toward heating systems. The summer comes around and the last season's difficulties are forgotten only to be repeated the next season, when the old excuse is raised "can't shut down now as tenants must have heat."

The better policy is to take stock of the complaints and difficulties during the heating season and to apply the proper remedies after the heating system is shut down.

Building superintendents, engineers and others responsible for the maintenance of comfortable temperature conditions within buildings should make a log of winter complaints to guide them in their summer check-up of heating systems equipment and operation.

One common complaint on steam installations, for example, is "lack of heat" in certain rooms or sections of a building. This complaint is sometimes coupled with another, "noisy operation." The correction of the latter condition frequently corrects the former as this combination of difficulties may be due to:

(a) pockets of water in radiator connections
(b) pockets of water in steam main
(c) pockets of water in return piping
(d) priming boiler
(e) leaks in return lines
(f) dirty or damaged steam traps on steam mains, riser drips or radiators
(g) clogged strainers ahead of traps or at the suction of vacuum pumps.

This is but one of the various problems of heating system supervision which make a systematic survey of the entire heating system advisable during the summer months, preferably immediately after the closing down of the heating system. Such a survey may well begin in the boiler room.

The Boiler

The following points merit attention in checking the condition of the various types of boilers in common use:

Fire-box, Brick-set Boilers

On fire-box, brick-set boiler installations, check should be made for air leaks through brick settings and around firing and ashpit and uptake doors. These are a common source of heat waste. An asbestos or asbestos cement lining applied to the inside or outside of uptake doors will make for a cooler boiler room with a reduction in heat loss from boiler.

The internal brick work of the fire-box of brick-set boilers should be given attention and repaired with suitable refractory material. There are several of the mastic types of material now on the market which make repairing of boiler combustion space a quick and simple procedure.

All ashes should be cleaned out from the ash pit and grates. Ash pits, fire doors, uptake doors and breeching dampers should be left open, so that air can circulate through boiler and smoke stack during the summer to keep the fire surfaces of boiler dry.

Dampness

If boiler room is inclined to be damp, a good plan is to place a pan of lime on the grate. This will absorb the moisture in the air as it passes through the boiler. It should be changed occasionally as the lime slakes out and becomes inactive to absorb moisture. This procedure will retard rusting of tubes and shell of steam boilers.

Soot

Of course, all soot should be removed from the tubes and shell of boilers and from the smoke breeching to prevent the action of moisture in the air on the sulphur in the soot from affecting the metal of the boiler and the smoke breeching. More damage can be done by one summer of moist soot left in the boiler tubes and breeching than will result from operation during an entire heating season.

Water Tube Boilers

Water tube boilers should have baffles in combustion space checked and any holes or cracks should be repaired with refractory material following the manufacturer's instructions to the letter for the best results. Unless baffles are tight fitting to tubes and furnace, by-passing of gasses will result in considerable fuel waste. The metal surfaces that come in contact with the products of combustion should all be cleaned of soot as for fire-box boilers. Ashpit and fire doors should be checked to fit and where they are warped, they should be reset to fit snugly to their frames.

Leaky gaskets in water tube boilers should be replaced. A good plan is to remove all of the gaskets from the tube headers and clean the tubes of excessive scale. The boiler should be washed out, each tube individually. Rear or lower header should be cleaned out of all mud and the boiler left open for air to circulate through it until just prior to putting into commission for the heating season. A pan of lime in the combustion space of the boiler would be a help in preventing rusting in the event that the boiler room is damp during the summer. Ashes should be cleaned out from grate and ash pit and also the fly ash from the tubes passing through the combustion space. All soot should be removed from the smoke breeching immediately after the shutdown of the heating plant.

Cast Iron Boilers

Cast iron boilers should be checked to see that the cement or filling between the different sections has not fallen out causing the by-passing of gases of combustion direct to the breeching instead of their proper passage through the heat absorbing surfaces of the boiler. The internal passages of the boiler should be thoroughly flushed out and, where possible, air permitted to circulate through the boiler all summer. Where such is not possible, then the boiler should be filled with water to just above the level of the steam outlet. This will prevent rusting at the water line of the boiler and assist in maintaining clean water in the boiler during the next season.

Blowing Down Boilers

All boilers should be blown down immediately after the close of the heating season in order to remove the scale while it is yet soft, together with mud. Where possible, air should be permitted to circulate through the boiler by leaving the cleanout doors and the manhole covers open.

The boiler manufacturers are only too willing to co-operate by furnishing proper instructions for the care of each particular make and type of boiler during the summer shutdown period.

Boiler Covering

One of the things which is given a great deal of inattention is the covering on boilers. It is frequently allowed to get in a bad state of repair. In consequence, heat dissipates from the boiler to the boiler room, creates excessive boiler room temperatures and is a source of fuel waste. Boiler covering should be gone over at this time of year and, where found broken, should be repaired, so that all circulation of air over the surface of boiler (between boiler covering) is stopped by making sure that openings at the top and bottom of covering do not permit this circulation.

Covering should be applied to boilers with an air space between the outside boiler surfaces and the inside of the covering. This will materially aid in the insulating effect of the covering. A properly covered boiler should have an outside surface temperature that is not appreciably hot when felt by the hand.

Safety Valves

Safety valves should be inspected, especially where boilers serve sub-atmospheric steam heating systems. The seat should be cleaned and, where necessary, reground to prevent inleakage of air into the system which would interfere with circulation and prolong the length of time that the vacuum pump would have to operate to maintain satisfactory vacuums or differentials when the heating system is operating under sub-atmospheric pressures.

Pumps, Boiler Return Traps, and Boiler Water Feeders

Pumps, return traps and boiler feed apparatus should next be given attention. Motors of pumps should be removed from boiler room and stored in a dry place where boiler rooms are inclined to be damp during the summer. Dampness in boiler rooms will oft times cause condensation to form on the inside of motor winding which may result in a burned-out motor when applying the juice at the start of the heating season. Care should be taken to save all shims under motor and to note just where they were placed to ensure their replacement in the proper position when realigning the motor. Receiving tanks should either be drained out and the drain left open with the air vent left open so that air can circulate to keep them dry all summer, or, where this is not possible, the receivers should be filled completely. This will prevent rusting at water line level in the receiver. The outside of steel receivers should be checked over for rust spots, cleaned, and a coat of paint applied. This will add much to the length of life of the apparatus.

Glands of centrifugal pumps which have been difficult to keep tight during the heating season may be caused by scored shafts. These should be taken out and polished or replaced and new packing inserted according to the manufacturer's instructions. It is always wise to use the packing recommended by the manufacturer. Other packing will not always do. Do not pack the packing too tight as usually the pump water-end bearing is water lubricated from the water pressure developed in the pump housing and the gland must necessarily drip a few drops of water per minute during period of operation. This drip indicates that water is passing through it to provide lubrication.

Electric switch mechanisms on motor starters, float switches and vacuum switches should be inspected, cleaned and oiled and contact points cleaned of all arc burns. If the contact points indicate severe arcing, stiffness in the mechanism may be the cause. A thorough cleaning of the mechanism and an oiling will oft times remedy this condition.

Boiler return traps should be opened and all working parts cleaned and oiled to prevent rust and corrosion during summer months. If this is done, efficient operation will be ensured and the life of the trap will be materially lengthened. It is wise not to change adjustments as the proper adjustment of the weights and floats is necessary for the proper functioning of this piece of apparatus. If the return trap is giving trouble, refer the matter to the manufacturer, stating the particulars of the difficulty. Usually manufacturers can furnish the necessary instructions for the correction.

Air Vents and Eliminators

Air vents on gravity steam jobs should be given attention. The air eliminators usually have a float valve mechanism. This should be cleaned and oiled and new gaskets installed and air check examined and cleaned so it will function to prevent reentry of air into the system when rate of combustion is retarded, thereby permitting an induced vacuum and aiding in prolonging circulation which makes for economy of operation.

Gauges

Steam gauges should be checked, especially on very low pressure installations, as a gauge "out" only a few ounces may result in improper pressure being carried. On gravity systems where pressures are carried too high, an air-binding condition may result and the heating-up period be lengthened with resultant fuel waste.

Water gauge glasses on boilers should be cleaned and where necessary, new rubber gaskets or washers used and gland nuts made tight against steam or air leaks.

With the above items checked and attended to, the boiler room can be considered as having been put in first class summer condition, ready to give a good account of itself during the next heating season.

Piping and Radiation

Attention should now be given to the piping and radiators. A survey of complaints during the past heating season should be made and where these show continued hard-to-heat conditions, check the following:

Water Pockets

1. Pockets of water in riser runouts and runouts to radiators. Where pockets occur, they prevent the condensate clearing away from the steam or return passages and prevent the steam from entering the piping beyond the pocket or the air from passing into the return piping. Quite frequently the raising of a radiator on small blocks of wood will correct improper grading and will result in the elimination of the trouble for individual radiators. When several radiators on one riser are affected all in the same manner at the same time, then the base of return or steam risers should be inspected for pockets. A pocket in a return pipe is just as effective in preventing circulation as one in a steam pipe. This procedure should also be followed when noise in radiators or piping has been a source of complaint, as usually one condition is responsible for the other.

Strainers and Drip Traps

2. All strainers on drip lines ahead of drip traps should be cleaned out as should strainers at receivers or at suctions of pumps. Drip traps should also be cleaned. When re-assembling drip traps and radiator traps, especially of the thermostatic type, it is always essential that the gasket which may be used in replacement shall be of the same thickness and material as supplied originally with the trap. Otherwise the adjustment of the thermal element within the trap will be affected. If the gasket is too thin, water may be held up in the piping ahead of the trap. On the other hand, if the gasket is too thick or if another gasket is applied together with an old one, the trap will fail to close and steam will pass into the returns with very unsatisfactory results. Gaskets should be obtained from the manufacturer of the trap.

Radiator Traps

3. Radiator traps should be cleaned with a rag moistened with gasoline. All grease and scale should be cleaned off the thermostatic member, the valve and the seat of the trap. Do not use emery cloth or other abrasive material to clean seats or valves of thermostatic traps as usually traps are manufactured to certain defined limits. Continued wearing of contact faces of valves and seats by the use of abrasive material would change this limit and cause uneven surfaces preventing the trap from closing off tight.

It is to be noted that steam leaking into a return will frequently affect thermostatic traps further along the system causing them to close off and hold water in radiators. "Water hammer" may result with serious damage to their thermostatic elements. These thermostatic elements are of necessity sensitive instruments and should not be subjected to shocks which may break joints of their assembly or fracture the metal allowing the thermostatic fluid to leak out rendering the thermostatic element useless to react to temperatures within the radiator.

Radiator Valves and Gate Valves

Radiator valves and gate valves should be checked for leaks at the stem. Renewal of packing or tightening of the packing gland nut should be done when necessary. Gaskets and flange joints should also be given attention and where stains at flanges indicate a leak, the gaskets should be removed and after flanges have been thoroughly cleaned a new gasket should be installed. Gaskets should be, preferably, of graphited asbestos material. Never use rubber gaskets on steam heating systems. They dry out and harden and are a source of trouble.

Operating Pressures

Quite frequently boilers must be operated at 5, 6 or 10 pounds pressure for kitchen equipment or for processing equipment and this pressure may be carried also in the heating system.

There are just as many heat units in a pound of steam at 2 pounds pressure as there are at 10 pounds pressure. Radiator traps are designed by most manufacturers to operate continuously at pressures around 2 pounds and less. Subjecting radiator traps to pressures higher than 2 pounds will eventually shorten the life of the trap, just as the driving of an automobile at 60 to 70 miles per hour will shorten its life or send it to the garage for repairs sooner than would be the case if it were driven within the legal speed limits at all times.

This continued carrying of excessive pressures on thermostatic elements sometimes causes maintenance costs which seem to be out of all proportion to the cost of other buildings. It is strongly recommended that on all heating systems where boilers must operate at pressures above 2 pounds for the equipment other than the heating system, a pressure reducing valve be installed between the boiler and the heating system proper, this reducing valve to be set to maintain pressure from atmosphere to 2 pounds. A marked reduction in the cost of maintenance and repairs to the thermally-operated equipment of the heating system will be effected.

While considering reducing valves, the suggestion is made that in every case where these are to be installed on a heating system, the actual load in pounds of steam per square foot of radiation should be furnished to the supplier of the reducing valve so that a reducing valve of the proper capacity for the load in question may be obtained. A reducing valve installed on the basis of piping already on the job usually will be much too large for the load it will have to carry. With the result that in order to maintain the desired low pressure under such circumstances, the reducing valve would have the seat and valve so close together that their surfaces are always in contact with steam at extremely high velocities causes wire drawing and very quickly renders the valve useless. A reducing valve selected on the basis of the required flow of steam through it under the desired pressure conditions will operate with much greater clearance between the valve and the seat and the velocity of the steam passing through the valve opening will be considerably lower than would be the case if the valve was too large in size. Additionally, low pressure regulation will be more closely maintained.

Window Waste

Do not overlook leaking windows as a source of heat complaints. Quite often even the addition of extra radiation to overcome apparent coldness in rooms will not correct the condition because of the infiltration of cold air from leaking windows. The summer time is a good time to inspect all windows, tighten up stops or install weather stripping. This form of protection against air leakage usually pays goods returns on the investment, as drafty windows sure do keep the coal shovel busy in the winter.

Comparing Fuel Consumption

It is well to check the performance of your heating system with that of more modern installations. Modern systems developed in the last 8 or 10 years show such substantial reductions in fuel consumption over older types that it becomes advisable for owners to investigate the possibilities of a thoroughgoing modernization of existing systems. Such an investigation involves a comparison between the actual fuel consumption and the fuel consumption which would be anticipated with suitable up-to-date appliances installed. Usually the investment in more up-to-date appliances applied to old heating systems can be anticipated to be repaid in 4 to 5 years by the fuel savings made. Increased heating comfort and tenant satisfaction are also to be weighed.

Sub-atmospheric steam is now a most popular medium for heating. Such systems operate with from 25 to 40% less fuel cost than systems which were considered up-to-date 8 or 10 years ago. The control apparatus used with this type of system is adaptable to old as well as new installations making modernizing feasible for many present installations in which fuel costs are high and heating satisfaction is low.

One of the most popular slogans today is "Modernize." The possibilities of modernizing heating installations can only be disclosed by a careful engineering survey and these can be carried out most readily in the summer time.

Temperature Regulation Equipment

Temperature regulation equipment should be given some attention. On electrically operated apparatus, it is well to inspect the contact points. These points should be cleaned where necessary so that proper contacts will ensure smooth operation of the apparatus.

Where air operated temperature control equipment is installed, the compressor should be checked for loose holding-down bolts which, from the writer's experience, have oft times been responsible for non-operation of the compressor and the entire control system. The reason given for the non-operation of the apparatus was that the compressor, when running, made too much noise. This could have been eliminated by tightening up bearings and holding-down bolts and the application of cork under compressor bed plate.

Piping connections between the compressor, air storage tank and pipe lines out into the system should all be checked for leaks. Leakage of air from the pipe line will cause the compressor to operate longer per day than otherwise would be required.

Air operated thermostats are sometimes rendered inoperative by the collection of lint and dust. Especially is this evident where vacuum cleaners are not made use of for the cleaning of the building. Removal of the covers of the thermostats and thorough blowing out and cleaning of all lint and dust from the apparatus will make for smoother operation.

Manufacturers' Co-operation

Manufacturers of the particular types of apparatus installed in the boiler room and throughout the building will furnish the necessary instructions to keep their equipment in first class condition. They have a mutual concern with the operator of the building in the satisfactory performance and maintenance of equipment carrying their name and their co-operation is gladly accorded.

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